From: Susan Kralj
To: Planning Comments
Subject: Distillery SUP
Date: Tuesday, February 11, 2020 11:18:22 AM

Regarding the proposed distillery, the issue of water usage is of utmost importance. We must have accurate, precise information concerning usage and waste water treatment.
Sent from my iPad

Comment 29

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I Great Falls, MT 59401
Phone: 406-454-6905 | Fax: 406-454-6919
Email: planningcomments@cascadecountymt.gov

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: Claire Reichert Baiz

Complete Address: 117 W. Grove St. # 204, Mishawaka IN 46545

Comment Subject (please check one):

☒ Special Use Permit Application ☐ Subdivision ☐ Zoning Text and/or Map Amendment

☐ Growth Policy ☐ Variance ☐ Floodplain Regulation Amendment

☐ Subdivision Regulation Amendment ☐ County Road Abandonment/ Discontinuation of County Street

☐ Other (describe): Re: Silver Falls S.U.P. 3 Feb. 2020

Comment

While it is legal to have the same person serve as president, secretary, treasurer and sole director of a corporation, the Silver Falls Distillery, as part of a GFDA-supported investment, would have been more impressive with local representation on its initial filing. If the proposed "boxing facility" becomes a true distillery, why didn't it attract local grain farmers as investors?

Friesen is kicking at the knees of mega-slaughterhouse opponents by attempting to vest Cascade county in these ancillary projects, which may not have a legitimate future. Their success is secondary to their purpose - exhausting the legitimate opponents of a disastrous project.

Aside from these existential issues, Mr. Friesen's application for an SUP is inadequate.

* it fails to differentiate between a bottling plant and a distillery. Each merits its own SUP.
* it fails to include water metering.
* wastewater is also a concern.

A recent documentary, We Believe in Dinosaurs, highlighted an underestimated impact of a significant rural employer, miles outside town. Williamstown, Kentucky, 2.1 miles from the Ark Encounter, was forced to provide costly emergency services. Please assure taxpayers, including my family in Cascade County, that ALL Madison Food Park proposals + SUPs include emergency service costs.

I urge you to reject this Special Use Permit.

Claire Reichert Baiz, Montana expat

For Office Use Only

Date Received:		Date Reviewed:		Complete:	☐ Yes	☐ No

Comment 30A

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I Great Falls, MT 59401
Phone: 406-454-6905 | Fax: 406-454-6919
Email: planningcomments@cascadecountymt.gov

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: Carolyn K. Craven

Complete Address: 101 14th Avenue South, Great Falls MT 59405

Comment Subject (please check one):

- ☒ Special Use Permit Application
- ☐ Subdivision
- ☐ Zoning Text and/or Map Amendment
- ☐ Growth Policy
- ☐ Variance
- ☐ Floodplain Regulation Amendment
- ☐ Subdivision Regulation Amendment
- ☐ County Road Abandonment/ Discontinuation of County Street
- ☒ Other (describe): Silver Falls Distillery & Bottling Plant SUP

Comment

01.19.20 SFD Background Info & Questions ZBOA
01.22.20 SFD Wastewater ZBOA
01.26.20 SFD Traffic ZBOA
02.05.20 SFD Fire & Emergency Vehicle Access Concerns ZBOA
02.06.20 SFD Traffic Concerns ZBOA
02.07.20 SFD Cumulative BSC-SFD Impact ZBOA
02.10.20 SFD Water ZBOA
02.10.20 SFD Wastewater Addendum ZBOA
02.11.20 SFD Water ZBOA

For Office Use Only					
Date Received:		Date Reviewed:		Complete:	☐ Yes ☐ No

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

February 11, 2020

PUBLIC COMMENTS

MFP SILVER FALLS DISTILLERY & BOTTLING PLANT SUP
WATER

- **Water Usage Info from MFP Silver Falls Distillery SUP**
  - The Proposed Plan of Operations adopted for Madison Food Park (MFP), as drafted by the project development team, includes the following assumptions related to the development of and access to a source of onsite water. The development plan for accessing the source of the water required for utilization at MFP already includes the installation and development of two (2) exempt production wells which will draw water from the Madison Formation located beneath the property; a third exempt well will be installed if deemed necessary. Water used at the distillery and domestic usage will be supplied via onsite wells, a series of transmission mains and potentially storage tanks.

- **Water Usage Per MFP**
  - Per SFD SUP "The distillery will require a relatively small volume of water estimated at 1,600 gal/day".
  - Distillery estimated water usage is **1,600 gal/day = <u>1.28-1.52 ac-ft/yr</u>**
    - 5-day week = 416,000 gal = 1.276 ac-ft/yr
    - 6-day week = 496,000 gal = 1.522 ac-ft/yr

There are no calculations and cited references to support how this above amount was determined

- **Definitions**
  - *Distillery* – A facility receiving milled grains and conducting the process to make bulk alcohol, and often to finished product. Process steps include cooking, fermenting, distilling and storage/maturing.
    Beverage Industry Environmental Roundtable (BIER); *A Practical Accounting of Water Use in the Beverage Sector,* 2011, p23.

  - *Bottling* – Locations where concentrate, syrup, flavors/infusions and/or bulk alcohol are blended with water and packaged into various container types. Facilities which received bulk finished product (such as completely brewed beer) for further packaging are also defined as bottling facilities. No fermenting or distilling processes are conducted at bottling facilities.
    Beverage Industry Environmental Roundtable (BIER); *A Practical Accounting of Water Use in the Beverage Sector,* 2011, p23.

C.K. Craven
Homeowner

- **Quantity of Liquors/Spirits at Peak Production from MFP Silver Falls Distillery SUP**
  - Yield will increase from 500,000 bottles in year 1 to 1,200,000 bottles in year 2, and 2,900,000 bottles in year 3.
    - Each bottle is 750 mL = 0.75 L
    - 2,900,000 bottles @ 0.75 L = 2,175,000 L
    - 2,175,000 L x 0.264172 gal/L = 535,424 gallons alcohol produced/year

1 L = 0.264172 gal
10 L = 2.64172 gall

- **Craft Spirits Market**
  - Craft spirits distilleries come in all shapes and sizes from a one-person operation making a barrel per week to distillers making up to 750,000 proof gallons annually. The global craft spirits market is segmented into three distiller sizes, namely, large, medium, and small, based on their production capacity. The large distilleries dominated the global industry, accounting for 59.3% share of the revenue in 2016. Distilleries with a production volume between 100,001 and 750,000 gallons are classified as large. *Retrieved from internet on 02.03.20*
    ACSA Releases 2018 Craft Spirits Data Project, Distillery Trail; Sept 28,2018.
      - Silver Falls Distiller peak production is estimated at 535,424 gallons alcohol/year, which is a large craft spirits distillery.

- **Equipment Used for Distillery Info from MFP Silver Falls Distillery SUP**
  - The distillery processing facility will incorporate the following equipment:
    - Distillers / distiller towers, condensers, fermenters & vertical blenders
    - Storage tanks, bottling equipment, chillers
    - Grain handling system
    - Q.C. laboratory, storage rooms
    - Packaging equipment, testing equipment and air compressors
    - High-pressure washing & sanitation equipment
    - Clean-in-place system

- **Traditional Water Use in Beverage Industry**
  - Direct water usage refers to the amount of surface and groundwater consumed as the result of producing a beverage
    - Consumptive water use includes:
      - Water that is evaporated
      - Water that is incorporated into a product
      - Water that is not returned to the same basin from where is was withdrawn
      - Water that is not returned during the same time period

        Beverage Industry Environmental Roundtable (BIER); *A Practical Accounting of Water Use in the Beverage Sector,* 2011.
        The *Water Footprint (WF) Assessment Manual*

C.K. Craven
Homeowner

- **Distillery Water Usage Info from Various Research and Trade Articles**
  - Distillation process applications use water for:
    - Fermentation of corn, wheat, rye, wheat, barley, sorghum, molasses in water with a typical ratio of 1.5-2.0 lbs grains per 1 gal water.
      - Vodka is traditionally made from potatoes or fermented cereal grains. Whiskey is generally made from fermented grain mash including barley, corn, rye, and wheat. Rum is made by using the byproducts of sugarcane (i.e. molasses).
    - Yeast propagation
    - Steam for distillation process
  - Distillery non-process applications use water for:
    - Cooling tower water
    - Water and steam for cleaning
      - Still and fermenter must be thoroughly cleaned between batches
    - Treated water for liquor preparation prior to bottling
      - Prior to bottling, water is typically added to it to dilute it to about 40 percent alcohol by volume (40% = 80 proof)
  - The Beverage Industry Environment Roundtable revealed that **distilleries have the highest water-use ratio range of all the beverage sectors.**

    (BIER) report, *Water Use Benchmarking in the Beverage Industry, Trends and Observations*, 2011. Plus several trade articles.

- **Amount of Distillation Process Water Used for Alcohol Produced**
  - Trade articles generally report a minimum amount of water used of 1.5 gal water to 2.0 gal water used per 1 gal alcohol produced in distillation process (unsure exactly what is included i.e. steam distillation etc.) *www.clawhammersupply.com*
    - MFP estimates 2,900,000 bottles (750 mL each) = 535,424 gal liquor/yr
    - 535,424 gal alcohol produced x *1.5 gal water/gal alcohol* = 803,136 gal water used = **2.46 ac-ft water used/year**
    - 535,424 gal alcohol produced x *2.0 gal water/gal alcohol* = 1,070,848 gal water used = **3.29 ac-ft water used/year**

2.46 to 3.29 ac-ft/year

- **Importance of Water Quality in Liquor Products**
  - Water sources, and their unique and distinctive attributes, have a huge impact on the specific flavors and qualities of spirits from around the world
  - Water quality and purity is even more important for spirits other than whiskey though, where barrels and the aging process may account for upwards of 60 percent of the whiskey's final character. Vodka, for instance, has no such helpers along the way to producing a desirable flavor profile.
  - Local water may contain chlorine, iron, manganese, chloramines, tannin, nitrate, TDS, sodium, chlorides, sulfates and many other elements, which are not desirable for distilling alcohol, so the distillers may use a reverse osmosis procedure to purify the water needed to dilute the alcohol prior to bottling

- One vodka distiller states "the biggest piece is water-it is the number one ingredient in vodka"

  From Emen, J. Water's hidden role in spirts across the globe", Nov 15, 2015.

- **Diluting Alcohol Concentration with Water Immediately Prior to Bottling**
  - A bottle of vodka is made of approximately 60 percent H20.

    Augustine C. *Water is the Secret Key to Making Great Vodka*. 08.12.161
    - Most Vodka is bottled at 40% ABV (alcohol by volume), which means it is 40% alcohol and 60% something else. The same is true for other spirits such as whisky or cognac. The 'something else' is primarily water - 40% alcohol means 60% water. Today, vodka is so highly distilled, it is almost pure alcohol after distillations, and water is added when it's bottled.
    - Using vodka as an example, peak production of 535,424 gal of liquor would need 60% water to dilute the alcohol prior to bottling. The amounts are similar for whiskey.
    - Whiskey is diluted to ~40% using 60% pure water.

      Karlsson BC, Friedman R. Dilution of whiskey-the molecular perspective. *Scientific Reports* Vol 9 No 6489;2018.

      Also confirmed 60% water to dilute vodka prior to bottling, by phone inquiry to manager at Distilled Resources (formerly Silver Creek Distillery) in Idaho on 01.27.20.
  - Since 60% water seems appropriate from the trade and research articles for vodka and whiskey, the calculations for the amount follow.
    - Peak production is estimated at 2,900,000 bottles (750 mL) annually
    - Converting 750 mL bottles to gallons results in 535,424 gal/year
    - Calculating 60% of that amount for water added in the bottling phase to dilute the amount of alcohol to typically 40%/80 proof results in 535,424 gal x .60 = <u>321,254 gal/year of pure water needed to dilute the alcohol, which = **0.99 ac-ft of water used/year for dilution of the alcohol**</u>.
      - This 0.99 ac-ft of water used/year is only for the <u>dilution of the alcohol</u> prior to bottling
      - This amount is very close to the <u>MFP total amount</u> of 0.92-1.09 ac-ft/year of water used in the <u>entire process of distillation and bottling.</u>

- **Unknown Water Usage Amounts for the Distillery**
  - There is no mention of anything related to the bottling process and if there is compressed air or water used to clean the new bottles before they are filled
  - There is insufficient information to know the total quantity of water needed throughout the distillation and cleaning process. From the consensus in trade articles and the citation below, the following information suggests considerable water use.

    Jacques KA, Lyons TP, Kelsall DR. *The Alcohol Textbook* 4th edition, 2003.

C.K. Craven
Homeowner

  - The still and fermenter must be thoroughly cleaned between batches, typically using high-pressure devices (100-120 psi) with a minimum of pre-rinse with water 10 min, detergent circulation 20 min, post-rinse with water 10 min, sterilization 10m. Cleaning requires not one, but several cleaning loops.
  - Per *The Alcohol Textbook*, the flow rate through a spray head to clean the inside of the fermenter has a velocity of 410 gal/minute.
    - ✓ From the info above, just the 10 min pre-rinse and 10 min post-rinse with water at a velocity of 410 gal/minute would use, at a minimum, 8,200 gal for 20 minutes of high pressure cleaning the fermenter.
  - The grain fermentation process involves typically a ratio of 1.5 lbs to 2 lbs of grains per gallon of water. No information available on how many pounds of grains go into each batch.

- Wastewater from Cleaning and Domestic Use
  - MFP estimates wastewater from cleaning to be 1,150 gal/day, which equals 1.09 ac-ft/year for a six-day work week, which is planned by peak production.
  - MFP estimates wastewater from domestic use to be 450 gal/day, which equals 139,00 gal/year or 0.43 ac-ft/year for a six-day work week.
    - This does not consider the additional hours and employees planned by peak production per information in the SUP.

- Water Use for Cleaning and Domestic Use
  - MFP did not identify cleaning and domestic water use in the total of 1,600 gal/day but rather included cleaning and domestic water only in the wastewater section. Water is used in the cleaning processes and domestic use and then becomes wastewater. The MFP estimates for cleaning and domestic use appears to be unrealistically low, but will use that data as part of the water usage.
    - Cleaning water amount = **1.09 ac-ft/year**
    - Domestic use amount = **0.43 ac-ft/year**

- Estimated Minimum Water Usage Amounts for Distillery
  - For distillation & dilution = **3.45 to 4.28 ac-ft/year**
    (From The Alcohol Textbook and various trade articles published in the distillery industry)
  - For cleaning and domestic use = **1.52 ac-ft/year** *(From MFP wastewater info)*
  - Unanswered specific questions including, but not limited to, water amounts used in preparation and fermentation of the mash, amount for high-pressure cleaning, sanitizing, cooling tower, and other equipment and processes.

Estimated Minimum Water Usage
4.972 ac-ft/year to 5.802 ac-ft/year

C.K. Craven
Homeowner

The ZBOA and the County Commissioners need detailed and accurate information about all the water usage in order to make a responsible and informed decision on behalf of the citizens and taxpayers of Cascade County.

- **Our Right to Clean Water - Our Responsibility to Protect Our Water**
  - "Since the rivers, lakes, streams and reservoirs are the highest priority landscape unit in terms of agriculture, aesthetics, wildlife habitat and recreation, development of water systems for domestic and agricultural uses should be subject to review by the Cascade Conservation District and should be in compliance with Montana's Stream Bank Preservation Act (SB310)".
    Cascade County Growth Policy (CCGP) 2014; Section 7.2 p52
  - "Assure clean air, clean water, a healthful environment and good community appearance." *Cascade County Growth Policy 2013; Goal 2 D.*
  - In Montana, our "inalienable rights" include "the right to a clean and healthful environment." Article II of the MT Constitution
  - "The state and each person shall maintain and improve a clean and healthful environment for present and future generations."
    Article IX, Section 1 of the MT Constitution.

QUESTIONS

1) How did MFP determine estimated water usage? Please provide your calculations, as based on the research for liquor distillery standards, for the amount of estimated water use.
2) How did MFP determine the peak output at 2,900,000 bottles of finished product? That seems to be fairly specific so MFP must have specific calculations to provide
3) Will the distillery and the cheese plant each have a dedicated well or will they share the two wells that MFP plans to drill? How will MFP/SFD monitor the amount of water used?
4) Will the results of the well drilling depth, flow rate and other information be available for public access and, if so, how does the public obtain those results?

C.K. Craven
Homeowner

5) How many water storage tanks will there be? What is the holding capacity of a storage tank? Will these storage tanks be reserved only for fire protection?

6) Where will the water storage tanks and fire hydrants be located on the parcel?

7) Does MFP/SFD plan to use any treatment processes to remove unwanted minerals and maximally purify the water for dilution just prior to bottling? If so, what treatment process do they plan to use (i.e. reverse osmosis, etc.)?

8) Please clarify the statement that "water use for the site must be reviewed and approved by the MT DEQ."
   - Does DEQ do an onsite inspection after the well is drilled to check well flow, depth and quantity per flow rate? Or does DEQ just examine the paperwork submitted after an exempt well is drilled?

9) Our Cascade County Growth Policy and the MT Constitution both state we have the right to a "clean and healthy environment", that "our rivers, lakes, streams and reservoirs are the highest priority landscape", that the county "assures clean air, clean water, a healthful environment and that the "state and each person shall maintain and improve a clean and healthful environment for present and future generations".
   - What responsibilities do our elected and appointed officials have to protect our waters?

10) Since the rivers, lakes, streams and reservoirs are the highest priority landscape unit in terms of agriculture, aesthetics, wildlife habitat and recreation, development of water systems for domestic and agricultural uses should be subject to review by the Cascade Conservation District and should be in compliance with Montana's Stream Bank Preservation Act (SB310).

    Q: Has the Cascade Conservation District reviewed the wells, transmission lines and storage tanks/locations for the MFP proposal?

    Q: Does the Cascade Conservation District have a formal assessment tool to determine compliance? If so, will it be available for public review? If not, why not?

11) Would the ZBOA consider requiring an aquifer test?

Respectfully submitted,

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

Montanans for Responsible Land Use

C.K. Craven
Homeowner

Comment 31A

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I Great Falls, MT 59401
Phone: 406-454-6905 | Fax: 406-454-6919
Email: planningcomments@cascadecountymt.gov

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: Carolyn K. Craven

Complete Address: 101 14th Avenue South, Great Falls MT 59405

Comment Subject (please check one):

- [x] Special Use Permit Application
- [ ] Subdivision
- [ ] Zoning Text and/or Map Amendment
- [ ] Growth Policy
- [ ] Variance
- [ ] Floodplain Regulation Amendment
- [ ] Subdivision Regulation Amendment
- [ ] County Road Abandonment/ Discontinuation of County Street
- [x] Other (describe): Silver Falls Distillery & Bottling Plant SUP

Comment

01.19.20 SFD Background Info & Questions ZBOA
01.22.20 SFD Wastewater ZBOA
01.26.20 SFD Traffic ZBOA
02.05.20 SFD Fire & Emergency Vehicle Access Concerns ZBOA
02.06.20 SFD Traffic Concerns ZBOA
02.07.20 SFD Cumulative BSC-SFD Impact ZBOA
02.10.20 SFD Water ZBOA
02.10.20 SFD Wastewater Addendum ZBOA

For Office Use Only					
Date Received:		Date Reviewed:		Complete:	☐ Yes ☐ No

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

February 10, 2020

PUBLIC COMMENTS

MFP SILVER FALLS DISTILLERY & BOTTLING PLANT SUP
WASTEWATER ADDENDUM

Comment on sources of information…

- **Validation of Research Scientists in India**
  - In my public comment on wastewater submitted on 01.22.20, I used a few references from the research on distilleries and distillery effluent in India.

  - There are highly trained researchers, doctors and scientists in India, many of whom were likely educated in the United States. International conversation among researchers via the published studies is common and expected. The global body of research on a myriad topics in medicine, biology, environment, engineering and numerous other professional areas has become widely available to the general public.

  - Scientists publish their results in peer-reviewed journals or they present their results at scientific conferences around the world. Either venue promotes additional dialogue among scientists.

  - The commercial distillation process for alcoholic liquors/spirits is well-established around the world.

  - The raw materials used for making a distilled spirit are of two basic types: (1) those containing a high concentration of natural sugars (i.e. molasses, sorghum) or (2) those containing other carbohydrates (i.e. corn, rye, barley, wheat) that can easily be converted to sugars by enzymes

  - The distillation effluent (wastewater) is similar for the above ingredients. An initial ingredient may be sugar. If the initial ingredients are starches, ultimately enzymes convert those starches to sugars in the fermentation stage.

  - There were several studies with similar results on amount of effluent in distillery wastewater per liter of alcohol produced, which I cited and incorporated in my comments.

C.K. Craven
Homeowner

- A larger, comparative study of Swiss and Indian scholars revealed that articles written by Indian researchers had shorter reference lists and were more likely to cite articles from open access journals. The effect sizes reported by Gaulé were small, though. Controlling for the publication source, Indian reference lists were 6% (less than 2 references) shorter and contained just 0.16 more citations to open access articles. Indian scholars routinely requested copies of articles from the authors of the studies and from their colleagues at better-endowed institutions.

  Davis PM, Walters WH. The impact of free access to the scientific literature: A review of recent research; J Med Libr Assoc, 99:3 208-17, 2011.

- U.S.-India Consortium Will Advance Cutting-Edge Technologies that Promote Greater Energy Independence and Economic Growth *News Release July 21, 2017*

  WASHINGTON – Today, the Department of Energy (DOE) announced an award of $7.5 million for a joint U.S.-India five-year project that will help advance the development of the power grid. The Indian Ministry of Science and Technology and industry partners will match DOE's commitment, bringing the total commitment to $30 million. This initiative, supported by DOE's Office of Electricity Delivery and Energy Reliability builds on the Department's commitment to fostering the reliable, resilient, and secure delivery of electricity needed for strong U.S. national security, economic growth, and global leadership, as well as furthering DOE's collaboration with India under the U.S.-India Partnership to Advance Clean Energy (PACE).

**This item is solely for the purpose of confirming the global credibility of researchers in India.*

Respectfully submitted,

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

Montanans for Responsible Land Use

C.K. Craven
Homeowner

Comment 32A

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I Great Falls, MT 59401
Phone: 406-454-6905 | Fax: 406-454-6919
Email: planningcomments@cascadecountymt.gov

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: LaLonnie Ward and Dennis Ward

Complete Address: 70 McKinior Road, Highwood Route, Great Falls, MT 59405

Comment Subject (please check one):

- ■ Special Use Permit Application
- ☐ Subdivision
- ☐ Zoning Text and/or Map Amendment
- ☐ Growth Policy
- ☐ Variance
- ☐ Floodplain Regulation Amendment
- ☐ Subdivision Regulation Amendment
- ☐ County Road Abandonment/ Discontinuation of County Street
- ☐ Other (describe): Madison Food Park / Silver Falls Special Use Permit Application

Comment

Please see the attached:
Public Comment (1 page)
Referenced publication "Recommended Fire Protection Practices for Distilled Spirits Beverage Facilities" (125 pages)

For Office Use Only					
Date Received:		Date Reviewed:		Complete:	☐ Yes ☐ No

Members of the Cascade County Zoning Board of Adjustment,

As we unfortunately have already witnessed over the last year, and even just this month, fast-moving, wind-driven, grassland wildfires are a real hazard in our area. Because of such continual risk, the consideration of best practice fire protection is essential to public safety.

Recognizing the potential for fires in distilling facilities, The Distilled Spirits Council of the United States (DISCUS), has developed guidelines for fire prevention, safety and protection for their industry. The attached DISCUS publication "Recommended Fire Protection Practices for Distilled Spirits Beverage Facilities" was prepared for new construction, and is well worth reviewing as you deliberate Madison Food Park's (MFP) Silver Falls SUP application.

The MFP Silver Falls SUP application addresses fire safety twice, and lacks specific detail for fire prevention and protection:

SUP Criteria Responses, p2.

1. The proposed development will not materially endanger the public health or safety.

> *b) Provision of services and utilities, including sewer, water, electrical, telecommunications, garbage collections, and fire protection:*

Response: Fire protection will be provided via onsite storage tanks and booster pumps.

SUP Criteria Responses, p10.

Goal 5: Preserve and enhance the rural, friendly and independent lifestyle currently enjoyed by Cascade County's citizens.

> *C) Promote fire prevention measures throughout the county, giving special emphasis to the extreme fire hazards present at the wild land-urban interface.*

Response: The project will incorporate onsite storage and pumps to provide onsite fire prevention measures to the structures. Additionally, the onsite fire storage may be available for adjacent properties in the event of emergencies, if necessary, as a hydrant can be placed onsite for local fire department use. The fire storage which may be used for regional firefighting activities will benefit all residents and land owners in the general vicinity of the project.

Prior to approval of the MFP Silver Fall SUP, a detailed plan for fire protection should be provided for consideration to the Cascade County Boarding Zone of Adjustment.

Comment 32B

Recommended Fire Protection Practices for Distilled Spirits Beverage Facilities

Third Edition

A SUGGESTED GUIDE

Prepared Under the Auspices of

The Distilled Spirits Council of the United States, Inc.

1250 Eye Street, NW, Suite 400
Washington, DC 20005

Third Edition
The Library of Congress catalog number: 92-74635

Distilled Spirits Council Of The United States, Inc.
1250 Eye Street, NW, Suite 400
Washington, DC 20005

June, 2005

Table of Contents

Chapter 1 Introduction 1-1

1-1 Scope 1-1

1-2 Purpose 1-1

1-3 Definitions 1-1

1-4 Units/Conversion Factors 1-5

Chapter 2 Characteristics of Alcohol-Water Solutions 2-1

2-1 Physical Properties of Alcohol-Water Solutions 2-1

2-2 Characteristics of Alcohol Vapors 2-2

Chapter 3 Processes 3-1

3-1 General 3-1

3-2 Grain Handling 3-1

3-3 Mashing and Fermenting 3-6

3-4 Distillation 3-6

3-5 Drying 3-7

3-6 Alcohol Processing 3-11

3-7 Barrel Warehousing 3-12

3-8 Barrel Fill and Drain Operations 3-14

3-9 Empty Wooden Barrel Storage 3-15

3-10 Storage of Empty Bottles and Packaging Materials 3-16

3-11 Bottling 3-17

3-12 Storage of Finished Case Goods 3-17

3-13 Storage of Distilled Spirits in Metal and Plastic Drums 3-18

Chapter 4 Protection Practices 4-1

4-1 General 4-1

4-2 Sprinkler and Water Spray Protection 4-1

4-3 Explosion Protection 4-1

4-4 Water Supplies 4-2

4-5 Water Demand 4-3

4-6 Other Extinguishing Systems 4-3

4-7 Alarm Systems and Watch Service 4-3

4-8 Exposure Protection 4-4

Chapter 5 Alcohol Handling 5-1
5-1 General 5-1
5-2 Tank Design and Construction 5-1
5-3 Tank Venting 5-2
5-4 Tank Location 5-4
5-5 Overflow/Overfill Protection 5-5
5-6 Spill Control 5-5
5-7 Ventilation 5-6
5-8 Piping, Valves, and Fittings 5-7
5-9 Loading and Unloading Facilities 5-8
5-10 Protection 5-8

Chapter 6 Electrics 6-1
6-1 General 6-1
6-2 Area Classification 6-1
6-3 Static Electricity 6-2
6-4 Lightning Protection 6-2
6-5 Electronic Equipment 6-2

Chapter 7 Equipment 7-1
7-1 Mechanical Handling Equipment 7-1
7-2 Building Service Equipment 7-1
7-3 Process Equipment and Tools in Classified Areas 7-2

Chapter 8 Impairments, Maintenance and Inspections 8-1
8-1 Impairments 8-1
8-2 Maintenance 8-2
8-3 Inspections 8-4

Chapter 9 Emergency Planning 9-1
9-1 General 9-1
9-2 Planning 9-1
9-3 Emergency Activities 9-1
9-4 Emergency Organization 9-2
9-5 Watch Service 9-2

Appendix A Characteristics of Flammable and Combustible Liquids A-1

Appendix B Dust Properties B-1

Appendix C Sample Self-Inspection Form Grain Storage Facilities C-1

Appendix D National Electrical Code Criteria and Equipment Considerations D-1

D-1 Scope D-1

D-2 Class I Locations D-1

D-3 Class II Locations D-2

D-4 Non-classified Area D-3

D-5 Intrinsically Safe Electrical Equipment for Hazardous Locations D-3

D-6 NEC Grouping of Atmospheric Mixtures with Similar Flammable Characteristics D-3

Appendix E Sample Hot Work Permit E-1

Appendix F Sample Self-Inspection Form for Fire Prevention F-1

Appendix G Summary of Distilling Industry Fire Losses 1933 – 2004 .... G-1

Appendix H Bibliography H-1

Appendix I NFPA-FM-GE GAP Cross Reference I-1

Figures

Figure 1-1	Single-Rack Barrel Warehouse	1-6
Figure 1-2	Double-Rack Barrel Warehouse	1-7
Figure 1-3	Multiple-Rack Barrel Warehouse	1-8
Figure 2-1.2	Relative Rates of Burning	2-3
Figure 3-1.2	Sectional Diagram of a Terminal-Type Grain Elevator	3-19
Figure 3-1.4a	Typical Column Distillery Process for Alcohol Distillation	3-20
Figure 3-1.4b	Bourbon Whiskey Distillation with Doubler	3-21
Figure 3-4.10.2	Pressure/Vacuum-Relieving Seal Pot	3-22
Figure 4-2.2a	Single-Row Racks. Location of In-Rack Sprinklers	4-10
Figure 4-2.2b	Double-Row Racks. Location of In-Rack Sprinklers	4-11
Figure 4-2.2c-1	Double-Row Racks. Location of Sprinklers Under Bottom Barrels. (Jamieson or Burke System)	4-12
Figure 4-2.2c-2	Double-Row Racks. Location of Sprinklers Under Bottom Barrels. (Jamieson or Burke System)	4-13
Figure 4-2.2d-1	Double-Row Racks. Location of In-Rack Sprinklers at Each Catwalk Level (Diamond Stagger System)	4-14
Figure 4-2.2d-2	Double-Row Racks. Location of In-Rack Sprinklers at Each Catwalk Level (Diamond Stagger System)	4-15
Figure 4-2.2e-1	Multiple-Row Racks. Location of In-Rack Sprinklers	4-16
Figure 4-2.2e-2	Multiple-Row Racks. Location of In-Rack Sprinklers	4-17
Figure 5-9.3.1a	Grounding Connections for Tank Car Stations	5-12
Figure 5-9.3.1b	Grounding Connections for Tank Truck Stations	5-13
Figure 6-2.1a	Leakage Source Located Indoors, at Floor Level. Adequate Ventilation is Provided	6-5
Figure 6-2.1b	Leakage Source Located Outdoors, at Grade	6-5
Figure 6-2.1c	Tank Truck and Rail Car Operations – Side View	6-6
Figure 6-2.1d	Tank Truck and Rail Car Operations – End View	6-7
Figure 6-2.1e	Tank Rooms	6-8
Figure 6-2.1f	Outside Storage Tanks	6-9
Figure 6-2.1g	Barrel Fill or Drain	6-10
Figure 6-2.1h	Barrel Dump	6-10
Figure 6-2.1i	Barrel Conveyor	6-11
Figure 6-2.1j	Barrel Drain and Fill – Barrels in Vertical Position	6-11
Figure 6-2.1k	Bottling Filler	6-12

Figure 6-2.1l	Bottling Capper	6-12
Figure 6-2.1m	Indoor Tank With Outdoor Vent	6-13
Figure 6-2.1n	Plate & Frame Filter	6-14
Figure A-1	Relationship between flash point, flammable limits, temperature, and vapor pressure for acetone and ethyl alcohol. Liquid, vapor, and air in a closed container at normal atmospheric pressure	A-1
Figure A-2	Variation of lower flammable limits with temperature and pressure	A-2
Figure A-3	Variation of upper flammable limits with temperature and pressure	A-3

Tables

Table 1-4.1a	SI Conversion Factors	1-5
Table 1-4.1b	Standardized Conversions	1-5
Table 2-1.1	Flash and Fire Points of Alcohol-Water Solutions[1]	2-1
Table 2-1.2a	Physical Properties of Various Flammable Liquids*	2-4
Table 2-1.2b	Heat of Combustion and Flash Point for Gasoline and Various Ethyl Alcohol-Water Solutions	2-4
Table 3-9.2.5	Outdoor Storage of Used Barrels	3-16
Table 4-2.2a	Process Occupancies[1]	4-5
Table 4-2.2b	Storage Occupancies[1]	4-6
Table 4-2.2c	Sprinkler Protection Design Requirements for Single-Row and Double-Row, Racked Storage of Distilled Spirits in Barrels	4-7
Table 4-2.2d	Sprinkler Protection Design Requirements for Multiple-Row, Racked Storage of Distilled Spirits in Barrels	4-8
Table 4-2.2e	Recommended Criteria in Automatic Sprinkler Design for up to Six-High, Palletized Barrel Storage of Spirits[1]	4-9
Table 5-3.3	Required Thermal Venting Capacity *(Expressed in Cubic Feet per Hour of Air) Interpolation Permitted*	5-9
Table 5-3.5	Tank Wetted Area versus Cubic Feet per Hour for Free Ethyl Alcohol Vapor	5-10
Table 5-4.1.1	Outside Above Ground Tank Locations	5-11
Table 6-2.1	Area Classification	6-3
Table B-1	Dust Properties	B-1
Table I-1	Cross-Reference – NFPA Codes & Standards to FM Data Sheets and GE GAP Guidelines	I-2

Foreword

The Distilled Spirits Council of the United States, Inc. (DISCUS) is the national trade association representing the producers and marketers of distilled spirits sold in the United States.

Allied Domecq Spirits and Wine USA, Inc.

Bacardi U.S.A., Inc.

Barton Incorporated

Brown-Forman Corporation

David Sherman Corporation

Diageo

Future Brands LLC/Jim Beam Brands Co.

McCormick Distilling Co., Inc.

Pernod Ricard USA

Remy Amerique, Inc.

Sidney Frank Importing Co., Inc.

Suntory International Corp.

Todhunter International, Inc.

DISCUS
Fire Protection Committee

The DISCUS Fire Protection Committee is accountable to DISCUS membership for evaluating and proactively endeavoring to influence the applicable regulatory agencies, insurance companies and other standards making organizations to ensure that the fire protection standards and guidelines affecting the distilling industry are cost effective and appropriate.

This involves evaluating new fire protection technologies, and developing and sharing non-proprietary technical data, procedures, and other relevant information with DISCUS member companies consistent with the antitrust laws and with the fire protection community.

The DISCUS Fire Protection Committee has prepared this document. The Committee is composed of the fire protection representatives of the respective DISCUS member companies as indicated:

	Paul Schentag (Chairman) Allied Domecq Spirits & Wine Detroit, MI	
Lynn Addington Barton Brands Owensboro, KY	Peggy Kelley & Joe Pallardy Brown-Forman Corporation Louisville, KY	Roberta Barbieri & John Longo Diageo Stamford, CT
Jim Kyle Florida Distillers Co. Lake Alfred, FL	Donald Delano Fortune Brands Lincolnshire, IL	Stephen Kenkel Jim Beam Brands Co. Clermont, KY
Jim Kieffer (Consultant) Kieffer & Associates inc. Windsor, ON Canada	Peggy Grabau McCormick Distilling Co., Inc. Weston, MO	Peter Knack Pernod Ricard USA Lawrenceburg, IN
	Jean Gooding (Staff Liaison) Distilled Spirits Council of the United States, Inc. Washington, DC	

Preface

This publication is a suggested, voluntary guide for application primarily to new installations of distilled spirits production plants, including storage and warehouse facilities. It is not intended in any way to be an industry standard or code for regulatory purposes.

This information in this guide is not intended to apply retroactively to existing buildings or operations but any company, facility, or operation may choose to apply the principles and practices within this guide at existing facilities. This guide may also be especially useful in designing significant alterations or extensions to existing facilities or both.

While the development of this document is based on sound engineering principles, test data, and field experience, neither the Distilled Spirits Council of the United States, Inc., or its member companies, nor those participating in any of its activities accepts any responsibility or liability resulting from compliance or non-compliance with any of its provisions, for any restrictions imposed on materials or processes, or for the completeness of the text.

The Distilled Spirits Council of the United States, Inc. has no power or authority to require, police, or enforce compliance with the contents of this document; and any certification of products stating compliance with the requirements of this document is made at the sole risk of the certifier.

Chapter 1
Introduction

1-1 Scope

1-1.1 This Recommended Practices publication is intended for voluntary application to all new operations involved in the production, packaging, and warehousing of distilled spirits (beverages). Facilities should utilize only those portions of this guide that are pertinent to their own operations. This document is not intended for application to retail operations nor should it be considered applicable when in conflict with local regulations or restrictions.

1-2 Purpose

1-2.1 The purpose of this document is to provide the member companies of the Distilled Spirits Council of the United States, Inc., with guidelines that will provide them a reasonable degree of fire protection for their plants and other properties. The specified protection measures are based on sound engineering principles, test data, and field experience. This document is intended to be an aid to engineers and architects in the design and construction of new installations or significant alternations, modifications, or extensions to existing distilled spirits (beverage) production plants, including storage and warehouse facilities. It is not intended to apply to existing facilities, as to do so would generally be impractical, nor is it intended to be a life safety, personnel safety or environmental guide. These subjects are outside the scope and purpose of this document. This document represents the combined best professional judgment of its authors and is offered as suggestive only and not for use as an industry standard or code for regulatory purposes.

1-3 Definitions

1-3.1 The terms used in this document are, in some cases, unique to the distilling industry; and the common usage, as defined in dictionaries, may not be applicable. Within this document, these terms should be defined as follows:

Aldehyde or Head Column. A distillation vessel that removes heads in the alcohol process.

API. American Petroleum Institute

Approved. Means "acceptable to the authority having jurisdiction (AHJ)." In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of nationally recognized testing laboratories, inspection agencies, or other organizations concerned with product evaluations that are in a position to determine compliance with appropriate standards for the current production of listed items and the satisfactory performance of such equipment or materials in actual usage.

Auto Ignition Temperature. The temperature at which an air-vapor mixture will spontaneously combust.

Authority Having Jurisdiction (AHJ). The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" or "accepting" construction, equipment, installations, or procedures.

Barrel. A charred wooden process vessel made of bent staves held together with steel hoops, with the greatest diameter being at the center of the staves, known as the "bilge". Ends, known as "heads", are flat, and the rim formed by staves overlapping the heads is known as the "chime".

Beer. A liquid with a content of approximately 6-15% alcohol, which is resultant of the fermentation process. This liquid is the feed stock to the distillation process.

Bleve (Boiling Liquid Expanding Vapor Explosion). A term used to refer to a condition that may arise if a liquid in a vessel is heated quickly enough to cause rapid boiling and vaporization. As the liquid vaporizes, high pressures are generated in the vessel and eventually relieved through a violent explosive rupture of the vessel.

Blending. The reduction of proof with water or the combining of distilled spirits with other spirits of the same type, or other ingredients.

Capture/Intake Velocity. The amount of air movement required to pick up and move particulate matter or vapors or both in the direction of desired flow.

Cask. See Barrel.

Catwalk (In Barrel Warehouse). A plank or slatted walkway to allow access between racks in a barrel warehouse, usually at every third barrel level. Refer to Figures 1-1, 1-2, and 1-3.

Column. A vertical, cylindrical vessel fitted with internal trays and/or packing where components of a mixed feed stream are separated based on the volatility and/or solubility of the components in the feed stream.

Condenser. A heat-transfer device that reduces a thermodynamic fluid from its vapor phase to its liquid phase.

Container. Any vessel of 119 U.S. gallons (450 L) or less used for transporting or storing liquids.

Cooperage. Manufacture, maintenance and repair of wooden barrels; also the wooden vessel itself.

Cutting and Welding. See Hot Work.

Dephlegmator. Partial condenser.

Distilled Spirits. Ethyl alcohol, hydrated oxide of ethyl, spirits of wine, whisky, rum brandy, gin, and other distilled spirits, including all dilutions and mixtures thereof, for nonindustrial use. The term " distilled spirits" shall not include mixtures containing wine, bottled at 48 degrees of proof or less, if the mixture contains more than 50 percent wine on a proof gallon basis.

Double-Rack Barrel Warehouse. A structure having catwalks at the ends of each pair of adjoining racks. Refer to Figure 1-2.

Doubler. A type of still (generally a pot still) used in the production of some whiskies where the distillate of a beer still is further distilled to a specific proof.

Draft Floor. A non-load-bearing, intermediate construction separation in rack barrel storage warehouses – usually at every sixth tier vertically, designed to eliminate updrafts.

Draft Stop. A barrier preventing updrafts, usually within wall construction.

Dry Hydrant. An arrangement of pipe permanently connected to a water source, other than a piped, pressurized water supply system, that provides a ready means of water supply for fire-fighting purposes and that utilizes the drafting (suction) capability of fire department pumpers.

Dust-ignitionproof Equipment "(DIP)". A device with an enclosure that will exclude ignitable amounts of dust. In addition, the enclosure will not permit arcs, sparks, or heat generated inside the enclosure to ignite exterior accumulations of dust. This equipment is suitable for a Class II, Division 1or Zone 1 locations

Explosion-proof Electrics/Equipment "(XP)". Apparatus enclosed in a case that is capable of withstanding an internal explosion of a specified gas or vapor without ignition of a similar external mixture. In addition, the maximum external surface temperatures are below the ignition temperatures of the materials to which the enclosure may be exposed. Explosion-proof equipment is suitable for Class I, Division 1 or Zone 1 locations, i.e., NEMA 7, 8, and 9.

Explosion-Suppression System. A method of detecting and extinguishing an explosion at its inception – prior to the development of destructive pressures.

Extraction Column. A distillation vessel in which considerable dilution water is used to increase the volatility of the congeners present in the alcohol and thus enhances their removal.

Feed Plate. The plate in a column at which beer or other alcohol composition is introduced for distillation or separation.

Fire Point. The minimum temperature at which a liquid, in an open container, vaporizes and forms an air-vapor mixture above its surface that burns continuously when ignited.

Fire-Rated Wall. A wall having a fire-resistance rating of a specified number of hours. Such walls must be designed to remain stable for the specified time they are expected to endure the fire exposure. For purpose of this Guide, the terms fire wall, fire barrier, and fire partition are interchangeable with fire-rated wall. The specified hourly resistance rating will typically dictate the construction features of the fire-rated wall and whether a fire partition, fire barrier, or fire wall (with or without a parapet) is provided.

Fire-Resistive Construction. The use of building components in which the structural members including walls, partitions, columns, and roof are of noncombustible materials, all with a specific fire-resistance rating of at least three hours. This construction is classified Type I, under current classifications.

Fire Separation. An open space or fire-rated wall between two areas designed to prevent the spread of fire from one area to the other for a specified period.

Flammable (Explosive) Limits / Flammable (Explosive) Range. Flammable and explosive are used interchangeably. Flammable liquid vapors or gasses, when mixed with air and ignited, will burn, if unconfined, and explode, if confined. The minimum vapor concentration of the air-vapor mixture that will propagate flame is the Lower Flammable (Explosive) Limit "(LFL/LEL)". The maximum concentration of the air-vapor mixture that will support a flame is the Upper Flammable (Explosive) Limit "(UFL/UEL)". The range of vapor concentrations between the upper and lower limit is the Flammable (Explosive) Range. These limits are usually expressed as a percentage by volume of the vapor in air.

Flammable Liquid. Any liquid having a closed-cup flash point below 100°F (37.8°C). Class I liquids have a closed cup flash point below 100°F (37.8°C) and have a vapor pressure not exceeding 40 psia (2,068.6mm Hg) at 100°F (37.8°C). Class I liquids are further classified as follows: (1) Class 1A liquids – flash point below 73°F (22.8°C) and boiling point below 100°F (37.8°C); (2) Class IB liquids – flash point below 73°F (22.8°C) and boiling point at or above 100°F (37.8°C); (3) Class IC liquids – flash point at or above 73°F (22.8°C), but below 100°F (37.8°C). Distilled spirits and alcohol mixtures between 40° (20%) and 110° (55%) are a Class IC liquid; above 110° (55%) up to 190° (95%) are Class IB liquids. Note: Under DOT regulations and UN standards, which primarily affect the transportation of flammable liquids, a flammable liuid is defined as any liquid with a flash point below 141°F (60.5°C).

Flash Point. The minimum temperature at which a liquid gives off sufficient vapor to form an air-vapor mixture which will ignite momentarily under specified conditions (open or closed-cup).

FM / FM Global. Factory Mutual Insurance Company.

Fusel Oil. Impurities that occur as a byproduct of the distillation process, generally consisting of a mixture of amyl, butyl, propyl, and isoamyl alcohols.

Fusel Oil Concentrating Column. A distillation vessel in which low concentrations of fusel oils are concentrated to high levels before removal from the alcohol process system.

Gauging. The process of measuring alcohol content of distilled spirits or alcohol-water solutions.

Hazardous Area. Locations in which it is reasonable to expect an explosive atmosphere (vapor, gas or dust) does or could exist, i.e., locations where flammable liquids, flammable gases, or combustible dust producing materials either are or have been transferred, processed, manufactured, produced, stored or otherwise used.

Heads. Low-boiling-point constituents taken off the top of the still.

Heavy Timber Construction. Also known as plank-on-timber or mill construction. Bearing walls, or bearing portions are of noncombustible materials. Minimum fire-resistance of walls is two hours but greater fire-resistance may be needed, depending on construction or occupancy arrangements. Columns, beams and girders are commonly heavy timber with wood floor and roof construction built without concealed spaces. This construction is classified Type IV, under current classifications.

High Wine. Product of a second distillation process.

Hot Work. The use of either arc or open flame welding and cutting equipment, other open flame tools, equipment and devices, or spark producing tools. Also, Hot Work is the use of heat generating and/or ordinary electric tools, equipment and devices in "Hazardous Areas".

Inspection. An examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage.

Intrinsically Safe Electrical Equipment "(IS)". Equipment and wiring are designed to be incapable of releasing sufficient electrical or thermal energy, under normal or abnormal conditions, to ignite a specific hazardous atmosphere, in its most easily ignitable concentration. Intrinsically safe equipment is suitable for use in Class I, Division 1, or Zone 0, Zone 1 and Class II, Division I or Zone 1 locations.

Kettle - Column. The simplest form of an apparatus to produce grain neutral spirits utilizing a batch charge of high wines (80° - 100°). The apparatus consists of a vertical or horizontal cylindrical kettle equipped with a heating coil. The kettle is connected to a vertical cylindrical column fitted with flat horizontal plates with bubble caps, a dephlegmator (partial condenser) and final condenser.

LEL / LFL (Lower Explosive / Flammable Limit.) See Flammable Limits.

Low Wine. Product of the beer still process.

Maintenance. Work performed to keep equipment operable or to make repairs.

Mash. Any material capable of, or intended for, use in the fermenting process.

Mashing. The preparation of base ingredients for fermenting through the addition of water and sometimes heat.

Miscibility. The tendency or capacity of two or more liquids to form a uniform blend, that is, to dissolve in each other.

Multiple-Rack Barrel Warehouse. A structure having no catwalks within the rack perimeters. Refer to Figure 1-3.

NEMA. National Electrical Manufacturers Association.

NFPA. National Fire Protection Association

Noncombustible Construction. The use of building components in which the walls, partitions, and structural members are of materials that do not contribute fuel to a fire; however, the structural members may be damaged by heat. This construction is classified Type II, under current classifications.

Non-incendive Electrical Equipment "(NI)". Equipment and wiring are incapable of releasing sufficient electrical or thermal energy, during normal operating conditions, to ignite a specific hazardous atmosphere. Non-incendive equipment is safe for use in Class I, Division 2 or Zone 2 and Class II, Division 2 or Zone 2 locations.

Open-Rack Barrel Storage Warehouse. A single-story structure of considerable height in which there are no intermediate floors.

Ordinary Construction. The use of building components in which exterior bearing or non-bearing walls are of noncombustible materials having a minimum fire resistance rating of two hours. Roofs and floors are wholly or partly wood or other combustible material of smaller dimension than required for Heavy Timber Construction. This construction is classified Type III, under current classifications.

Ordinary Electrics. All NEMA types except NEMA 7, 8, and 9.

Pot Still. A vessel used in a distillation process in which heat to produce boiling is applied directly to the pot still.

Portable Tank. Any closed vessel having a liquid capacity over 60 U.S. gallons (227L) and not intended for fixed installation. This includes intermediate bulk containers (IBCs). Portable tanks have a maximum capacity of 660 U.S. gallons (2498 L) and IBC's have maximum capacity of 793 U.S. gallons (3000 L).

Processing. An integrated sequence of production operations. The sequence may include physical and/or chemical operations. The sequence may involve, but is not limited to, preparation, separation, weighing or mixing.

Process Tank. A type of process vessel whose capacity usually exceeds 60 U.S. gallons (227 L) and is intended for fixed installation.

Proof. The ethyl alcohol content of a liquid at 60°F (15.5°C), stated as twice the percent of alcohol by volume.

Rack Level. One horizontal level of barrels.

Racking Machine. A mechanical device to lift barrels into storage racks.

Recommended Practices. A document containing only advisory provisions (using the word "should" to indicate recommendations) in the body of the text.

Rectifying. Enriching a mixture of chemical components with the lower boiling components (more volatile components) through distillation. With ethyl alcohol distillation, rectifying a dilute mixture of water and ethanol results in a higher proof ethanol product.

Rectifying Column. A distillation column whose primary purpose is to increase the strength of the most volatile component in a chemical mixture. In an ethanol plant, a Rectifying column is used to raise the proof of the ethanol in the column's feed stream through distillation. A Rectifying column can serve additional purposes such as the removal of congeners like organic acids, esters, aldehydes and fusel oils and thus purify the ethanol as well as increase the proof of the ethanol product.

Ricking Machine. See Racking Machine.

Safe Hot Work Area. Locations meeting all provisions for a safe open flame/arc welding or cutting area, as required by the authorities having jurisdiction.

Single-Rack Barrel Warehouse. A structure having catwalks separating each rack from those on either side. Refer to Figure 1-1.

Slip Sheet. A thin, relatively flexible cardboard or plastic sheet used in lieu of pallets. A special fork arrangement on industrial (lift) trucks is required to accommodate this type of storage handling.

Solid Floor. A structural load-bearing floor (to differentiate from a draft floor).

Solubility in Water. A term expressing the percentage of a material (by weight) that will dissolve in water at ambient temperature. Note: Terms used to express solubility are: "negligible" (less than 0.1 percent); "slight" (0.1 to 1.0 percent); "moderate" (1 to 10 percent); "appreciable" (more than 10 percent); "complete" (soluble in all proportions).

Spills. The unintentional discharge of distilled spirits or other flammable or combustible liquids from tanks, piping, equipment, drums, barrels, bottles.

Standpipe. A system of fixed piping with valves, hose connections, and associated equipment installed in a building or structure to facilitate manual fire fighting efforts by either emergency response personnel or fire department personnel.

Still. A piece of equipment that separates alcohol vapor from a liquid mixture and then converts the vapor to a higher proof liquid.

Stillage. The grain, fruit, etc. residue from the manufacture of alcohol through distillation.

Storage Tank. Any non-process vessel having a liquid capacity exceeding 60 U.S. gallons (227 L) and intended for fixed installation.

Tails. High-boiling-point constituents taken off the bottom of the still.

Tank Vehicle. A vehicle equipped with a container for holding liquids or gases and designed to transportation standards to ensure safe transport on public "roadways". Examples of tank vehicles are tank cars used for rail transportation and tank trucks used for highway transportation.

Testing. A procedure used to determine the status of a system to ensure that it will perform in accordance with its intended operation or function.

Tier. See Rack Level.

UEL / UFL (Upper Explosive / Flammable Limit.) See Flammable Limits.

Vessel. Any hollow utensil used to contain materials especially liquids.

Water Miscible. The extent to which liquids or gases can be mixed or blended with water.

Wine. In the production of rum, a liquid fermented from molasses containing approximately 6% alcohol. Other variations include liquids fermented from fruit processing as well as the alcohol enriched products from a still (high wine or low wine).

Wood-Frame Construction. Exterior walls, bearing walls and partitions, floors, roofs and their supports are wholly or partly of wood or other combustible material when wood construction does not qualify as Heavy Timber Construction or Ordinary Construction. This construction is classified Type V, under current classifications.

Work Aisle. A platform for handling and loading barrels into the racks, erected at right angles to the racks, usually located three tiers above each other.

1-4 UNITS/CONVERSION FACTORS

1-4.1 The units of measure presented in this guide are in the English Foot-Pound system. Where appropriate, metric measurements, also known as International System of Units (SI), follow each value within parentheses. Conversion factors utilized in this guide are listed in Table 1-4.1a. Samples of standardized conversions (rounded) utilized in this guide are listed in Table 1-4.1b.

Table 1-4.1a
SI Conversion Factors

UNITS - ENGLISH to SI		
1 in	=	25 mm
1 ft	=	0.3 m
1 yd	=	0.9 m
1 ft^2	=	0.09 m^2
1 ft^3	=	0.03 m^3
1 gal	=	3.8 L
1 gal	=	3.8 dm^3
1 gpm/ft^2	=	41 mm/min
1 psi	=	0.069 bar
1 psi	=	6.9 kPa

Table 1-4.1b
Standardized Conversions

STANDARDIZED CONVERSIONS		
250 gpm = 950 L/min	14.7 (15) psi = 100 kPa = 1 bar	40°F = 5°C
500 gpm = 1900 L/min	7 psi = 50 kPa = 0.5 bar	165°F = 74°C
750 gpm = 2850 L/min	10 psi = 70 kPa = 0.7 bar	286°F = 141°C
1000 gpm = 3800 L/min	20 psi = 140 kPa = 1.4 bar	
2500 gpm = 9500 L/min	25 psi = 170 kPa = 1.7 bar	
	50 psi = 350 kPa = 3.5 bar	
1.3 gal = 5 L	75 psi = 520 kPa = 5.2 bar	
	100 psi = 690 kPa = 6.9 bar	
	150 psi = 1040 kPa = 10.4 bar	

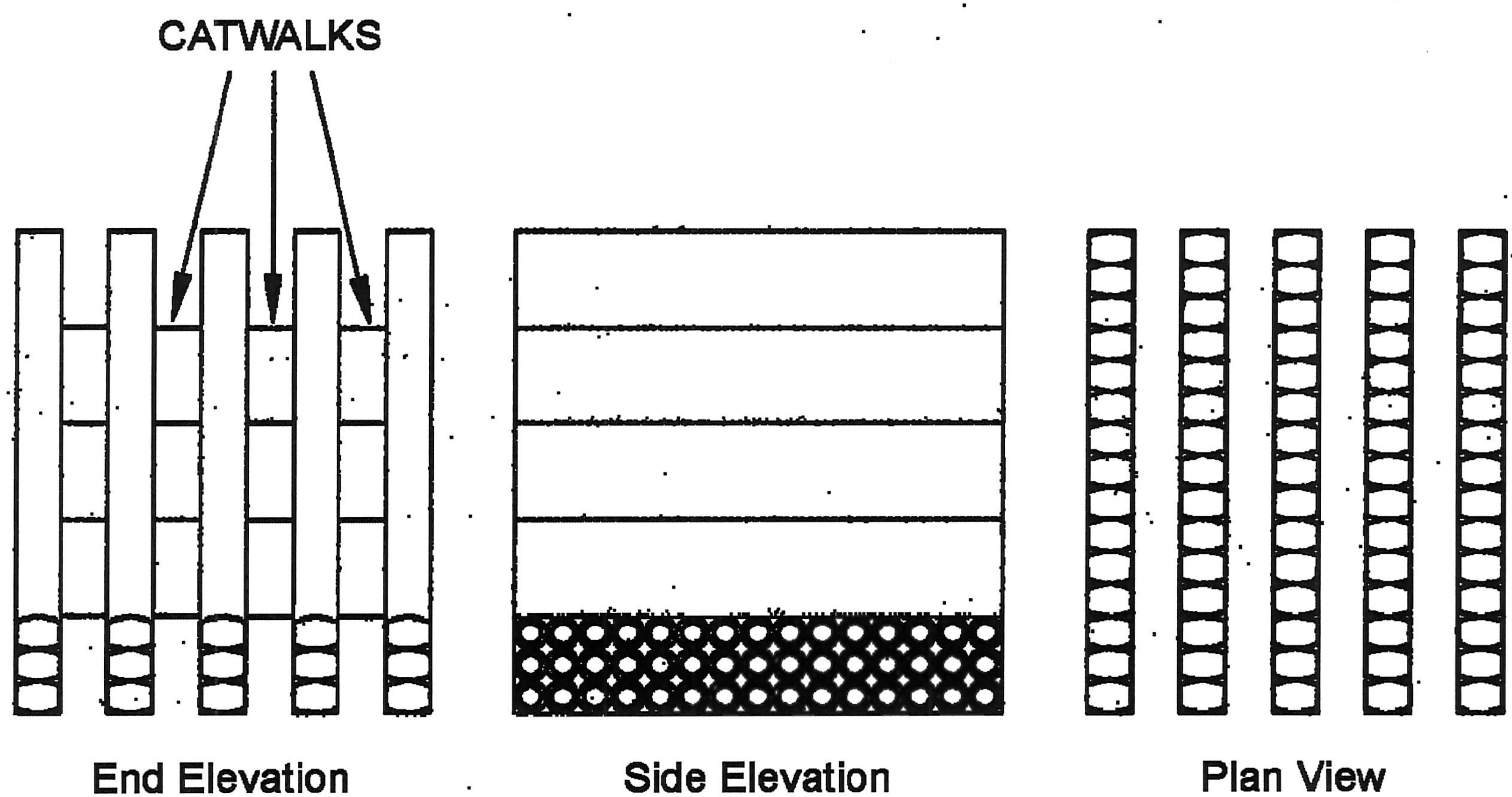


Figure 1-1 Single-Rack Barrel Warehouse

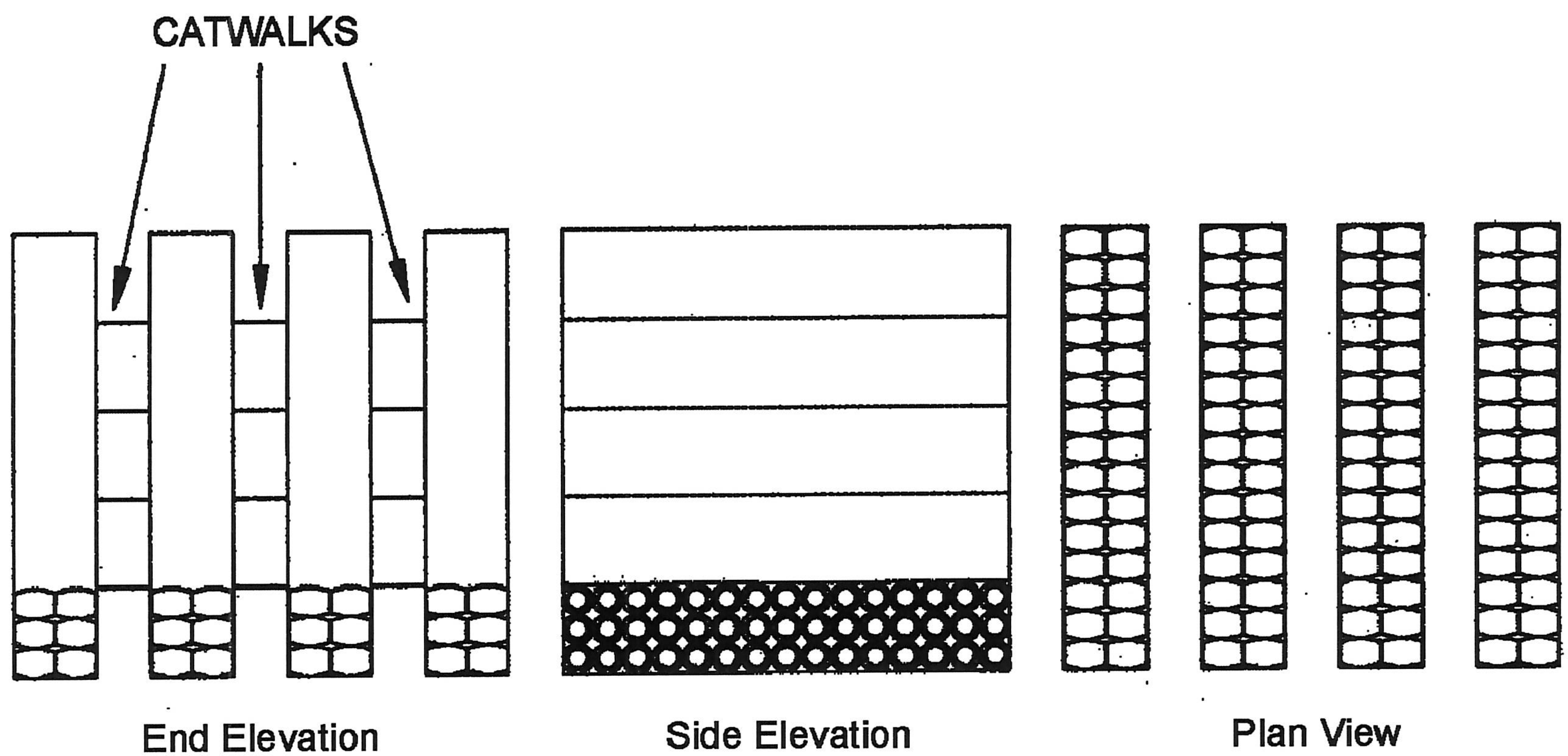


Figure 1-2 Double-Rack Barrel Warehouse

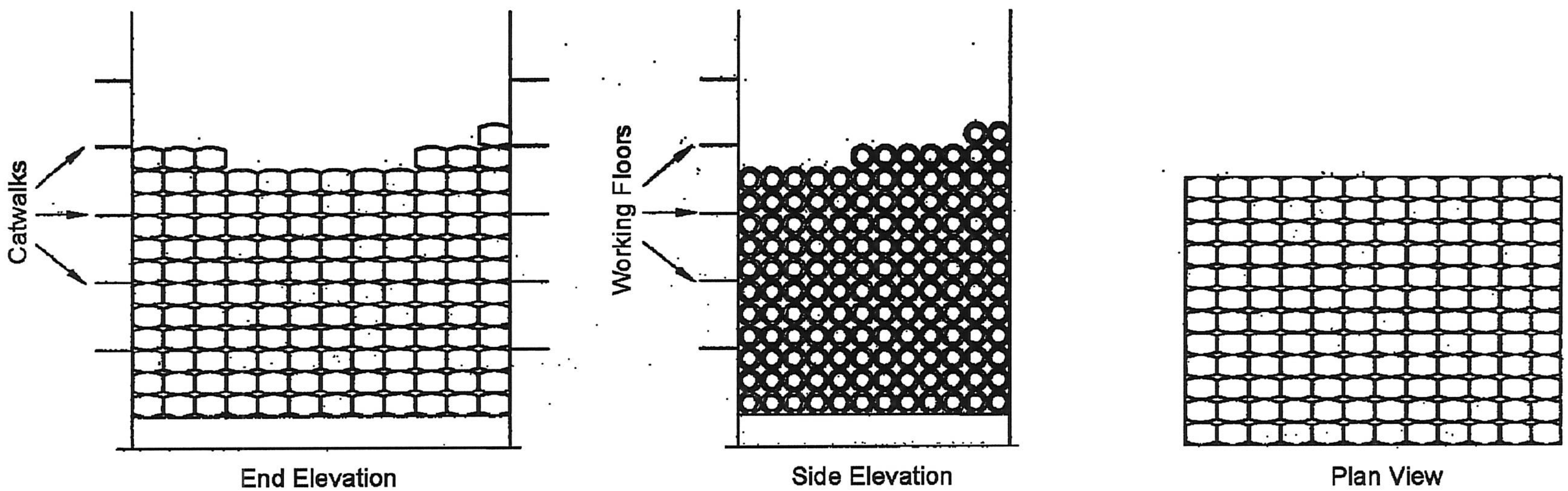


Figure 1-3 Multiple-Rack Barrel Warehouse

Chapter 2
Characteristics of Alcohol-Water Solutions

2-1 PHYSICAL PROPERTIES OF ALCOHOL-WATER SOLUTIONS

2-1.1 Alcohol-water solutions with a flash point of 100°F (38°C) or less (alcohol content of approximately 20% or more) are flammable liquids. Refer to Table 2-1.1.

Table 2-1.1
Flash and Fire Points of Alcohol-Water Solutions[1]

Alcohol (Vol. %)	Tag Closed Cup Flash Point[2]	Tag Open Cup Flash Point[3]	Fire Point[4]
Class IB liquids			
95%	63°F (17°C)	70°F (21°C)	70°F (21°C)
90%	65°F (18°C)	72°F (22°C)	72°F (22°C)
80%	68°F (20°C)	76°F (24°C)	76°F (24°C)
70%	70°F (21°C)	80°F (27°C)	80°F (27°C)
60%	72°F (22°C)	86°F (30°C)	87°F (30°C)
Class IC liquids (below 55%)			
50%	75°F (24°C)	90°F (32°C)	94°F (34°C)
40%	79°F (26°C)	96°F (36°C)	102°F (39°C)
30%	85°F (29°C)	104°F (40°C)	113°F (45°C)
20%	97°F (36°C)	119°F (48°C)	136°F (58°C)
Non-flammable liquid (below 20%)			
10%	120°F (49°C)	150°F (66°C)	---

Notes:

1. If an alcohol-water solution contains sugar or other dissolved solid material, the percentage of alcohol must be considered in relation to the water only, not the total solution.

2. From NFPA 325M, *Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids.*

3 & 4. From Factory Mutual Research Corporation.

2-1.1.1 Fire test and actual fire loss history (Refer to Appendices G and H) have proved that fire protection needs differ for ethyl alcohol and water solutions from most flammable liquids. Water is the most effective extinguishing agent for ethyl alcohol since it is water miscible. Unlike most petroleum-based products, ethyl alcohol is infinitely water soluble. Additionally, ATC (Alcohol type) foam and multi-purpose dry chemical extinguishing agents are also very effective on alcohol fires.

2-1.2 Control of ceiling temperatures preventing deformation of structural steel during an alcohol fire may be achieved with about half the sprinkler density needed for most other flammable liquids because:

a) The solubility of the alcohol in water is complete. The theoretical amount of water needed for extinguishment of an alcohol-water solution can be determined by the following formula:

Water needed =

$$\left[\frac{\%\text{ alcohol before fire}}{20\%} - 1\right] \text{x volume of alcohol}$$

Since this formula depends on complete mixing, a greater quantity of water from sprinklers or hose streams may be necessary for complete extinguishment.

b) Vapor and heat release are being continuously reduced by water application;

c) The fuel consumption rate for an alcohol water solution is considerably less than for other flammable liquids when free burning. These statements are supported by test data shown in Figure 2-1.2, which shows rate of fuel consumed for 100-octane gasoline vs. 94% alcohol-water vs. 50% alcohol-water.

d) The heat of combustion value for alcohol-water solutions is 60% or less (depending on content of alcohol) than that of 100-octane gasoline as shown in Table 2-1.2b. A comparison of heat of combustion values for 100% ethyl alcohol and other similar flammable liquids is shown in Table 2-1.2a and;

e) The flash point and heat of combustion value of alcohol-water solution vary considerably with alcohol content. In distilleries the alcohol content may be as high as 94% (neutral spirits) but is normally between 65% (typical aging percentage) to 40% (typical bottling percentage) with correspondingly higher flash points and lower heat of combustion values, as shown in Table 2-1.2b.

2-2 CHARACTERISTICS OF ALCOHOL VAPORS

2-2.1 The vapor-air density of alcohol is 1.6 times that of air. Alcohol vapors are invisible, and the distance they will travel is not always apparent. Testing[1] indicates that beyond 18 in. from the source vapors are less than 25% of the LEL and beyond 5 ft. they are negligible.

[1] Testing done by DISCUS member companies and independent consultants.

Comment 32C

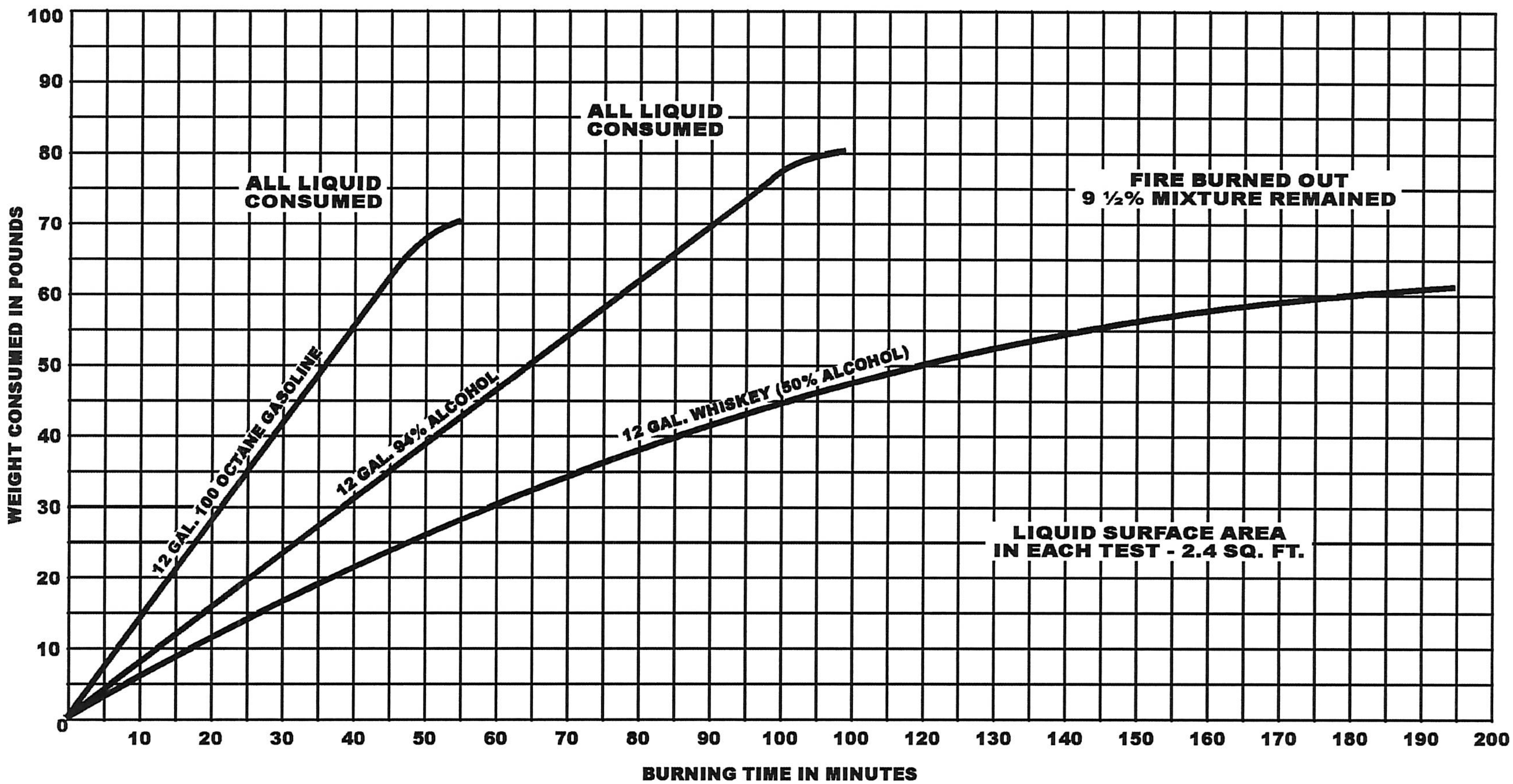


Figure 2-1.2 Relative Rates of Burning*

Relative Rates of Burning of:

100 Octane gasoline
Alcohol (94% commercial denatured)
Whiskey (50% is mixture of commercial alcohol and water)
*From Factory Mutual Research Corporation

Table 2-1.2a
Physical Properties of Various Flammable Liquids*

	Isopropyl Alcohol	Methyl Alcohol	Propyl Alcohol	Ethyl Alcohol	Acetone	Gasoline 100 Octane	Hexane
Flash Point °F (°C)	53-57 (12-14)	52 (11)	74 (23)	**55 (13)**	-4 (-20)	-36 (-38)	-7 (-22)
Auto Ignition Temperature °F (°C)	750 (399)	725 (385)	775 (412)	**685 (363)**	869 (465)	853 (456)	437 (223)
Lower Flammable Limits % by Volume	2.0	6.0	2.1	**3.3**	2.15	1.4	2.0
Upper Flammable Limits % by Volume	12.7	36	13.7	**19**	13	7.4	7.5
Specific Gravity (Water = 1)	0.8	0.8	0.8	**0.8**	0.8	0.8	0.7
Vapor Density (Air = 1)	2.1	1.1	2.1	**1.6**	2.0	3.4	3.4
Boiling Point °F (°C)	181 (83)	147 (64)	207 (97)	**173 (78)**	133 (56)	100-400 (38-204)	156 (69)
Water Soluble (Miscible)	Complete	Complete	Complete	**Complete**	Complete	Insoluble	Insoluble
Resistivities (Water = 2.5 x 10^7)(0hm-cm)	N/A	2.3 x 10^6	N/A	**7.4 x 10^8**	1.7 x 10^7	N/A	N/A
Heat of Combustion Btu/lb	N/A	9,600	14,193	**12,800**	13,228	20,750	20,731
Latent Heat Vaporization Btu/lb	287	474	296	**368**	224	145	144
Specific Heat °F Btu/lb	N/A	68 .600	77 .586	**148 .456**	68 .528	N/A	68 .538
Coefficient of Exp/ °F	N/A	.00072	N/A	**.00062**	.00085	.0006	N/A

N/A – Not Available

***Measured at Standard Temperature and Pressure**

Table 2-1.2b
Heat of Combustion and Flash Point for Gasoline and Various Ethyl Alcohol-Water Solutions

	Btu/lb	Tag Closed Cup °F (°C)
Gasoline (100 Octane)	20,750	-36 (-38)
Ethyl Alcohol 100% Alcohol	12,800	55 (13)
Alcohol-Water Solutions:		
94% Alcohol (neutral spirits	11,651	63 (17)
65% Alcohol	7,445	71 (22)
40% Alcohol (typical bottling %)	4,269	79 (26)

Chapter 3
Processes

3-1 GENERAL

3-1.1 The principal distillery operations are grain handling, mashing and fermenting, distillation, drying, alcohol processing, barrel warehousing, storage of empty bottles and packaging materials, bottling, and storage of finished case goods.

3-1.2 Any material rich in carbohydrates is a potential source of ethyl alcohol. These carbohydrates are obtained in the form of grains (usually corn, rye, wheat, and barley malt). The grains are received at the distillery in railroad cars, ships, and trucks and stored in silos until required for production. Refer to Figure 3-1.2.

3-1.3 These grains are then ground (milled), mixed with water (forming mash), and heated to convert the starches to grain sugar. Yeast is added to the grain sugar mixture, which results in fermentation and the conversion of grain sugar into ethyl alcohol and carbon dioxide. For rum production, a molasses mixture enters directly into the fermenting process without mashing.

3-1.4 Fermentation products, called "beer", consist of low-proof alcohol, water, and other by-products. Distillation is the process of removing the alcohol from this mixture. Stills are of many types and can be designed for batch or continuous operations. Refer to Figure 3-1.4a Typical 4 Column Distillation Process for Grain Neutral Spirits or Rum and Figure 3-1.4b Bourbon Distillation Process.

3-1.5 After distillation, the product is transferred by pumps or gravity through pipelines to tanks. Alcohol processing includes operations such as distilling, gauging, agitation, filtering, barrel filling, and barrel dumping. Residual non-alcohol bearing grains from the distilling process are sent to a "dry house".

3-1.6 Products that require aging are matured in wooden barrels in warehouses, either on racks or in a palletized configuration. The period of aging is determined by product type, flavoring requirements and/or by law.

3-1.7 Empty bottles and packaging materials are received at the facility for bottling of the processed product.

3-1.8 The bottling operation is usually partly or fully automated and includes filtering of the product, bottle filling, capping, labeling, and packing into cartons.

3-1.9 After bottling, finished case goods may be stored for a short period before shipping. Storage may be on racks, on pallets, or on slip sheets.

3-1.10 Other operations, such as empty barrel storage, cooperage operations, idle pallet storage, use of electronic control equipment, and drum storage may be encountered. Protection of these operations should follow the practices outlined in this chapter.

3-2 GRAIN HANDLING

3-2.1 General

3-2.1.1 Grains most commonly used in the production of distilled spirits are: corn, rye, wheat, and barley malt. At distilled spirits plants, grains can be received in rail cars, barges, ships, or trucks.

3-2.1.2 Grain is generally unloaded from the transportation vehicles by gravity chutes and then transferred by conveyor, elevator, pneumatics, or other suitable method to storage bins or directly to processing operations. Refer to Figure 3-1.2 for typical terminal grain elevator layout.

3-2.1.3 Grain purchased for a distilled spirits plant usually has moisture content at or below

14% and has been shelled, cleaned, and dried at country or terminal grain elevators. Before processing, grain may require additional cleaning and drying. This operation is generally done upon receipt of the grain and prior to storage or processing.

3-2.1.4 Processing of the grain prior to mashing always includes operations such as pulverizing or grinding, weighing, and conveying.

3-2.1.4.1 In the grinding operation, several different types of mills are typically used to produce consistent fine ground meal. The more common types include: roller mills and hammer mills.

3-2.1.4.2 In the weights operation, the grain meal is carefully weighed to provide accurate records and controlled formulation of mash ingredients to produce spirits of uniform quality.

3-2.1.4.3 Conveying of the grain from operation to operation is accomplished by gravity flow, mechanical conveyance or pneumatic conveyance. As with all grain processing operations, the potential for generating a combustible and/or explosive dust in the atmosphere is ever present.

3-2.1.5 For more detailed information on loss prevention for grain handling facilities refer to NFPA 61, *Prevention of Fires and Dust Explosions in Agricultural and Food Products Facilities*.

3-2.2 Occupancy

3-2.2.1 A modern grain elevator usually consists of a group of reinforced concrete silos, which are typically up to 100 feet (30 m) high. The capacity of each silo may exceed 25,000 bushels (88 m^3). Grain also may be stored in steel tanks or in storage buildings. Concrete silos generally have a tunnel beneath and an enclosure above containing conveyors leading to loading and unloading facilities. The conveyors usually run to a high multi-story elevator buildings or "headhouse" containing elevating, cleaning, weighing and other grain handling equipment. The grain elevator may include facilities for loading and unloading rail cars, trucks, barges, and ships.

3-2.2.2 Conveyors may be belt, screw, drag or pneumatic. Elevators may be either bucket or pneumatic. Withdrawal from silos and tanks is normally by gravity onto conveyors. Filling is generally by gravity from conveyors or elevators.

3-2.2.3 Drying equipment for grain and distillers' dried grain may be direct fired gas or oil or indirect steam heated air. Steam heated air presents a lower fire hazard, but may require larger boiler capacity.

3-2.2.4 Construction and occupancy details are outlined in NFPA 61, *Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities*. Additional references may be found in NFPA 68, *Guide for Venting of Deflagrations*; NFPA 77, *Recommended Practice on Static Electricity*.

3-2.3 Fire Development

3-2.3.1 Dust that has settled on ledges and other surfaces, especially heated surfaces, presents a potential fire hazard. Dust suspension in air creates a potential explosion hazard.

3-2.3.2 Dust explosions are possible wherever dry grain is stored or processed. Destruction can result from a series of explosions. The first explosion may be minor, but may create sufficient disturbance to disperse a larger dust cloud. The explosion then may be repeated on a larger scale. Successive explosions can cause more extensive damage in areas beyond where the first explosion occurred.

3-2.3.3 Grain dust can be very explosive. It is reported in tests only 0.055 ounces of corn dust particles per cubic foot are required to produce an explosive mixture in air. This is based on dust particle sizes that can pass through a 200 mesh screen. Smaller particles require an even smaller amount to produce an explosive mixture. With corn dust, an explosion can produce unvented pressure up to 113 psi with a rate of rise of 5600 psi/sec. Consequently, the maximum pressure, 113 psi, can develop in approximately 0.02 seconds. For comparison with other dusts – see Appendix B.

3-2.3.4 Factors which contribute to the frequency, and/or severity of dust explosions are:

a) Dust accumulation in areas surrounding equipment;

b) Ignition sources (stray ferrous metal particles, poorly designed and maintained electrical equipment and heat from friction in rotating equipment);

c) Openings in room walls and floors, bins or equipment;

d) Non-vented equipment;

e) Improper ventilation during construction periods;

f) Inadequate fire protection equipment;

g) Fire protection equipment that is subject to damage from explosions; and or

h) Unsafe operational practices and procedures from personnel.

3-2.3.5 The most severe fires in grain storage and processing areas occur in buildings of combustible construction, such as old elevators of wood or metal clad construction, or in noncombustible buildings where occupancy, other than grain, is combustible and sprinkler protection is lacking or damaged by explosions.

3-2.3.6 Fire may develop in grain storage silos or bins from spontaneous combustion caused by too much moisture in the grain. The generation of heat within the grain can have deleterious effects on grain quality long before a fire develops. Many facilities with long term grain storage have installed heat detectors to alert personnel of impending heat buildup. Whenever a fire develops in an area containing combustible dust the possibility of a dust explosion or a rapidly spreading fire exists. Often, dust explosions may lead to ensuing fires.

3-2.4 Construction

3-2.4.1 Silos, storage bins, elevator houses and structures containing grain milling and feed preparation processes should be of fire resistive or noncombustible construction. These structures should be separated from other operations and, when practical, from each other. Separation will help minimize propagation of dust explosions. Refer to NFPA 220, *Types of Building Construction.*

3-2.4.2 Interior surfaces should have a smooth, high-gloss finish to facilitate cleaning. Horizontal surfaces should be avoided, if possible, to minimize dust accumulation.

3-2.4.3 Storage bins, tanks and silos should be designed for maximum structural loading.

3-2.4.4 Silos and storage bins should have dust-tight and water-tight covers or decks. There should be no direct openings between bins and tanks. Vents for relieving dust laden air during filling should not discharge into conveyor enclosures. To avoid dust bridging and plugging, vents should not be offset more than 30° from the vertical. No more than three (3) bins or silos should be connected to a common vent.

3-2.4.5 Explosion Venting and Suppression

3-2.4.5.1 If practical, damage-limiting construction should be provided where dust explosion hazards exist. Explosion vents should be provided in areas where grain and grain products are handled and where dust deposits can accumulate. These areas include, but are not limited to: open conveyor areas, bulk grain loading and unloading areas and bag filling areas. Explosion venting is usually not practical in grain silos.

3-2.4.5.2 Vented areas should be designed and constructed in accordance with NFPA 68, *Venting of Deflagrations.*

3-2.4.5.3 Basement work areas such as conveyor tunnels, should be sufficiently above grade level so that adequate explosion venting to the outside can be provided.

3-2.4.5.4 If explosion venting cannot be installed, explosion-suppression systems should be considered. The systems should be designed to prevent propagation of flame from one area to another. Equipment located in such areas should be designed, maintained and operated to prevent dust accumulation.

3-2.5 Protection

3-2.5.1 Automatic sprinklers should be designed in accordance with Chapter 4 and installed in the following grain storage and processing buildings and equipment:

a) Buildings of combustible construction;

b) Noncombustible buildings containing combustible material other than grain;

c) Interiors of large indoor processing equipment; e.g., bag dust collectors, elevator and elevator legs of combustible construction;

d) At the top only, for noncombustible elevator legs;

e) All grain mill and dryer buildings; or

f) Over or in combustible grain conveyors;

3-2.5.2 In unheated grain handling areas, preaction systems are preferable to dry systems to minimize air discharge during initial operation. This will reduce the possibility of formation of a dust cloud during this period.

3-2.5.3 In many enclosed grain processing operations, a manually operated steam suppression (snuffing) system may be a more practical and preferred method of protection.

3-2.5.4 Sprinklers are not recommended inside grain storage bins or silos.

3-2.5.5 In standpipe systems, hose connection should be provided at all operating levels in grain elevator houses, conveyor facilities and cleaning and drying areas. Since some of these areas are normally unheated, a dry standpipe system should be equipped with a remote control operating device at each hose station. Refer to Chapter 4 and NFPA 14, *Installation of Standpipe and Hose Systems.*

3-2.5.6 An explosion-suppression system or spark detection system should be considered for dust collection systems taking suction from equipment with potentially high explosion frequencies, such as hammer mills. These systems should not be manifolded with other collection systems. Refer to NFPA 654, *Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids.*

3-2.6 Electrics Electrical equipment in grain handling should be designed for use in Class II, Group G. hazardous locations. Refer to Chapter 6.

3-2.7 Drainage All grain silos and storage bins should be arranged to prevent sprinkler water or surface water entry. Moisture will swell grain which may cause structural damage.

3-2.8 Ventilation (Dust Control)

3-2.8.1 Effective dust control is essential. The dust collection system should provide adequate intake velocity at dust discharge points or near dust-producing equipment to capture escaping dust particles. Refer to NFPA 61, *Prevention of Fire and Dust Explosions in Agricultural and Food Product Facilities*

3-2.8.2 A complete dust collection system should be provided with intakes at all dust emitting locations. This includes, but is not limited to, unloading dumps, conveyor transfer locations, elevator legs, and the headhouse; at sifting, cleaning, dehulling, and screening equipment; at binfilling and discharge points; and at milling and bagging operations.

3-2.8.3 Individual collecting systems should be provided for each area to confine explosion propagation to the local area. Electrical interlocks should be provided to prevent operation of dust producing processes when the dust collection system is not operating.

3-2.8.4 Dust collection equipment should be located outdoors. If equipment is located indoors, it should be located at an outside wall and vented through the outside wall in accordance with current design practices. Refer to NFPA 68, *Venting of Deflagrations.* An alternate design would be installation of an explosion-suppression system designed and installed in accordance with NFPA 69, *Explosion Prevention Systems.*

3-2.8.5 Enclosed grain processing equipment and conveying systems should be dust-tight and preferably operated under a negative pressure to minimize dust leakage.

3-2.9 Lightning Protection. Lightning protection should be provided for buildings and structures with grain handling operations. Refer to Section 6-4, "Lightning Protection".

3-2.10 Housekeeping

3-2.10.1 Proper housekeeping is the best safeguard for preventing dust explosions. Even with well-designed, dust-tight equipment, small amounts of dust will escape, accumulate and present a potentially serious hazard unless removed at regular intervals.

3-2.10.2 Dust accumulations should be removed by a combination of:

a) Vacuum Cleaning – Approved central systems are more desirable and may prove to be more efficient. Small portable units are acceptable if the equipment is of the approved type. Refer to Chapter 7.

b) Soft Push-brooms – This type of broom tends to minimize dust clouds when sweeping. However, they should not be used to remove dust from areas above the floor level. Pneumatic collector openings at floor level may be used to pickup sweepings. Clearance should be provided beneath and around equipment to permit sweeping or vacuum cleaning; or

c) Water spray may be used to wash equipment and buildings of combustible dusts.

3-2.10.3 The use of compressed air to blow down dust accumulation should be avoided. This method can stir up large dust clouds. Devices utilizing compressed air in combination with continuous suction to remove dust as it is dislodged may be used where clearance is too close for other methods. Dust accumulation thickness should not exceed 1/8 inch (3mm) in depth.

3-2.11 Other Recommendations

3-2.11.1 Exteriors and interiors of elevator, conveyor and processing equipment should be accessible for inspection and maintenance.

3-2.11.2 The use of motion detection devices and bearing over temperature alarms are very helpful in detecting conveying problems and can help to avoid jamming and possible ignition sources. Consideration should be given to installation of these devices in conveyor design.

3-2.11.3 Conveyor and elevator equipment should be equipped with jam protection or interlock devices so that slow down or stoppage of any piece of equipment in the system will shut down all preceding equipment.

3-2.11.4 Where practical, elevator enclosures should be extended without changes in size or direction to above roof level and provided with explosion-venting caps designed to relieve at 20 psf (138 kPa). For new installations, elevator legs should be located outside.

3-2.11.5 Heat sensors should be installed in grain silos and bins where spontaneous combustion may be a problem. Temperatures should be measured and recorded at least every four hours. Wet grain materials should not be stored in silos or bins.

3-2.11.6 Conveyors, mills and other process equipment should be electrically grounded and conveyor belts should be electrically conductive or equipped with static eliminators. Both types of static protection for conveyor belts should be considered. Refer to NFPA 77, *Static Electricity*.

3-2.11.7 Magnetic separators should be installed at rail car and truck dump hoppers, at all conveyors and ahead of milling or grinding operations to remove tramp ferrous metal.

3-2.11.8 Space heating equipment should have neither open flames nor any exposed surface at temperatures above 340°F (171°C).

3-2.11.9 Fumigation should be performed in accordance with procedures and practices contained in Annex C of NFPA 61, *Prevention of Fire and Dust Explosions in Agricultural and Food Products Facilities.* Refer to Section 8-2.4 "Fumigation."

3-2.11.10 Explosion-suppression systems may be utilized for small volume equipment, such as elevator legs or dust collectors. Refer to NFPA 69, *Explosion Prevention Systems*.

3-2.11.11 Preventative maintenance should be conducted. A typical inspection report is included in Appendix C.

3-3 Mashing and Fermenting

3-3.1 General

3-3.1.1 Mashing and fermenting are the processes that produce a liquid low in alcohol content for distillation. The liquid is not flammable.

3-3.1.2 Mashing is the preparation of the base ingredients for fermenting. For distilled spirits with other than a sugar molasses or agave base ingredient (e.g., corn, rye, wheat, barley), the base ingredient in a meal form is mixed with water and heated in metal tubs or vats (cooked). This process gelatinizes the starch, optimizing conditions for the conversion to sugar. The mixture is then cooled and malt or enzymes are added to assist conversion. The mixture is then pumped to either wood tubs or metal tanks for fermenting.

3-3.1.3 In the fermentation process, yeast is added to the mash mixture to convert sugar to ethyl alcohol, carbon dioxide gas and other byproducts. The non-flammable mash mixture is then transferred to the distillation process.

3-3.2 Occupancy Mashing is done in either open or closed vessels or steam pressure cookers. Steam pressure cookers are often operated in excess of 300°F (149°C) at 50 to 75 psi (345 to 517 KPa) (3.5 to 5.2 bar). Other vessels generally operate at atmospheric pressure at about 212°F (100°C).

3-3.3 Fire Development

3-3.3.1 There is no ethyl alcohol in the mashing process.

3-3.3.2 The alcohol content of the fermented liquid is approximately 6-15%. Consequently, it is a non-flammable liquid.

3-3.4 Construction. The building may be either fire-resistive, noncombustible or combustible construction.

3-3.5 Protection. Automatic sprinklers are recommended if construction or occupancy is combustible. Refer to Chapter 4.

3-3.6 Electrics. Ordinary electrical equipment is considered acceptable.

EXCEPTION: If the mashing and fermenting area is not a separate building from distillation there may be an explosion or flash fire potential, i.e., heated alcohol vapors under pressure escaping from the still. Consequently, one or a combination of the following should be considered to lower that potential.

a) Electrics provided throughout the mashing and fermenting areas should be approved for use in Class I, Group D, Division 1 or Zone 1 hazardous locations. Refer to Chapter 6.

b) Vapor-tight fire separation between the mashing or fermenting area and distillation.

3-3.7 Drainage. Ordinary industrial drainage is adequate.

3-3.8 Ventilation. Normal building ventilation is adequate.

3-4 Distillation

3-4.1 General. The product from the fermentation process, a non-flammable, low-proof alcohol mixture (beer), is transferred to the distillation process. Distillation is the process of separating and purifying this low proof alcohol mixture.

3-4.2 Occupancy

3-4.2.1 Stills are of many types and uses. The still commonly used to separate the low alcohol fermenter mixture is called the beer still. Only the mixture above the feed plate is flammable. Additional distillation systems from this point are either batch or continuous. Batch systems would be typically a pot still or a kettle and column. Continuous systems will normally contain one or more of the following types of still columns: doubler, rectifying, aldehyde, fusel oil concentrating, heads concentrating, extractive, purifying, or stripping.

3-4.2.2 Within a still the concentration of alcohol vapor usually exceeds the UFL. Any vapors escaping from a still should be considered a hazard and may be explosive when mixed with appropriate proportions of air in the presence of an ignition source.

3-4.3 Fire Development. Control methods of the greatest importance are prevention of discharge of vapors in the building and elimination of ignition sources within the equipment. Ignition sources external to the system should also be eliminated.

3-4.4 Construction. The building should be of fire-resistive or noncombustible construction and should have a fire separation from other operations. Refer to Section 4-8, "Exposure Protection".

3-4.5 Protection. Automatic sprinklers should be provided throughout the still house. Refer to Chapter 4.

3-4.6 Electrics. Electrical equipment within the still house should be designed for use in Class I, Group D, Division 1 or Zone 1 hazardous locations. Refer to Chapter 6.

3-4.7 Drainage. To control alcohol spills, a drainage system should be provided at all levels, except grated floors. For proper drainage system design refer to Section 5-6.4, "Interior Areas - Drainage and/or Containment Systems".

3-4.8 Ventilation. Ventilation should be provided (mechanically where necessary) to prevent accumulation of alcohol vapor from reaching 25% of the LFL. Refer to Section 5-7, "Ventilation".

3-4.9 Lightning Protection Lightning protection should be provided for the still house and buildings and structures handling alcohol operations. Refer to Section 6-4, "Lightning Protection".

3-4.10 Other Recommendations

3-4.10.1 Explosion venting if provided should approach, as nearly as practical, a ratio of one square foot for each 30 cubic feet of still house volume. Explosion venting should be designed in accordance with the NFPA 68, *Venting and Deflagrations.*

3-4.10.2 Each still should be protected for excess pressure and vacuum. It is recommended that all vents to the outside, and especially vents from vent condensers be equipped with flame arresters. For sizing of flame arresters, refer to Section 5-4, "Tank Venting", taking into account the strength of the vessel, pressure, and manufacturers specifications and recommendations. Refer to Figure 3-4.10.2.

3-5 DRYING

3-5.1 General

3-5.1.1 In the distilling process, material removed from the base of the beer still is called spent beer or whole stillage. This material typically contains only trace amounts of alcohol. This material can be sold in this semi-wet state as "slop" for use as animal feed or further processed into a dry product that is also sold as animal feed. The product is commonly called "Distillers' Dried Grain".

3-5.1.2 When the material is processed into dried grain, the liquid and solids are first separated. The liquid portion, called "thin stillage", is processed through evaporators to form "syrup" with a consistency of 30% to 40% solids. The syrup is added back to the separated solids for further drying. Some of the thin stillage may also be used in the mashing and fermentation processes. The separated solids are then further dried and become either "distillers' light dried grain" or "distillers' dark dried grain". Both light and dark grains are sold as animal feed

3-5.1.3 Conveying of the dried grain from operation to operation is accomplished by gravity flow, mechanical conveyance or pneumatic conveyance. As with all grain processing operations, there is a potential for generating a combustible and/or explosive dust cloud.

3-5.1.4 Good loss prevention programs are necessary in drying operations to reduce the possibility of fire or explosion hazard at drying facilities ("Dry House"). Refer to NFPA 61, *Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities.*

3-5.2 Occupancy

3-5.2.1 A modern dry house usually consists of a group of silos or tanks, which may be concrete, steel, or other materials. These silos or tanks are typically up to 100 feet (30 m) high. The capacity of each silo may be up to 25,000 bushels ($88m^3$). Dried grain also may be stored in storage buildings. Concrete silos generally have a tunnel beneath and an enclosure above containing conveyors leading to loading and unloading facilities. The conveyors usually run to a high multi-story elevator building or "headhouse" containing elevating and other grain handling equipment. The dry house may also include facilities for loading rail cars, trucks, barges, and ships.

3-5.2.2 Conveyors may be belt, screw, drag or pneumatic. Elevators may be either bucket or pneumatic. Withdrawal from silos and tanks is normally by gravity onto conveyors. Filling is generally by gravity from conveyors or elevators.

3-5.2.3 Drying equipment for distillers' dried grain may be direct fired gas or oil or indirect steam heated air. Steam heated air presents a lower fire hazard, but may require larger boiler capacity.

3-5.3 Fire Development

3-5.3.1 Distillers' dried grain is combustible. Buildup of distillers' dried grain, especially on heated or hot surfaces in the dryer house, should be avoided. Dust that has settled on heated surfaces presents a potential fire hazard that could be ignited from the heat source. Deposits of dried grain inside exhaust ducts should also be avoided. Overloading or over heating of these deposits in the exhaust ducts could cause a fire.

3-5.3.2 Distillers' dried grain dust, in suspension in the atmosphere, creates a potential explosion hazard; however, this is less than the explosion potential for cereal grain handling. Many of the factors that contribute to the frequency and/or severity of dust explosions with cereal grain dust also apply to distillers' dried grain. See Section 3-2.3, "Grain Handling – Fire Development".

3-5.3.3 Whenever a fire develops in an area containing combustible dust, the possibility of a dust explosion or a rapidly spreading fire exists. Often, dust explosions may lead to ensuing fires.

3-5.3.4 Severe fires in dried grain processing and storage facilities can occur if the buildings are of combustible construction, such as wood or metal clad construction, or in noncombustible buildings where the occupancy is combustible and/or sprinkler protection is lacking or damaged by a dust explosion.

3-5.3.5 Distillers' dried grains are susceptible to an exothermic reaction and can ignite spontaneously if not dried below 10%-12% moisture content and adequately cooled before shipping or storage.

3-5.4 Construction

3-5.4.1 Dry houses, including furnace rooms, should be of noncombustible or fire resistive construction. The dry house should be physically separated from other structures, including silos and storage bins, by at least 75 ft. (23m) distance and/or by a two-hour rated, vapor-tight, and dust-tight fire rated wall.

3-5.4.2 Interior surfaces of buildings should have a smooth finish to facilitate cleaning. Horizontal surfaces should be avoided, if possible, to minimize dust accumulation.

3-5.4.3 Steam coils should be arranged and maintained to prevent dust accumulations on coil and fin heating surfaces.

3-5.4.4 A method to remove possible clogs in the exhaust ducts of the dryer should be provided.

3-5.4.5 Air intakes should have bird screen covers and located in dust-free areas.

3-5.4.6 Silos, storage bins, tanks, and storage buildings should be of noncombustible or fire resistive construction. These structures should be separated from other operations. Separation will help minimize propagation of fire and/or a dust explosion.

3-5.4.7 Silos, storage bins, and tanks should be designed for maximum structural loading.

3-5.4.8 Silos, storage bins, and tanks should have dust-tight and watertight covers or decks.

There should be no direct openings between bins and tanks. Vents for relieving dust laden air during filling should not discharge into conveyor enclosures. To avoid dust bridging and plugging, vents should not be offset more than 30° from the vertical. No more than three (3) bins or silos should be connected to a common vent.

3-5.4.9 Explosion Venting and Suppression

3-5.4.9.1 If practical, damage-limiting construction should be provided where potential dust explosion hazards exist. Explosion vents should be provided in areas where dried grain products are handled and where dust deposits can accumulate. These areas include, but are not limited to: conveyor areas, dried grain loading areas and bag filling areas. Explosion venting is usually not practical in silos, storage bins, and tanks. Refer to NFPA 68, *Guide for Venting of Deflagrations.*

3-5.4.9.2 Lower level work areas such as conveyor tunnels, should be sufficiently above grade level so that adequate explosion venting to the outside can be provided.

3-5.4.9.3 If explosion venting cannot be installed, explosion-suppression systems should be considered. The systems should be designed to prevent propagation of flame from one area to another. Equipment located in such areas should be designed, maintained and operated to prevent dust accumulation.

3-5.4.9.4 Dryers should be equipped with explosion venting. Refer to NFPA 68, *Guide for Venting of Deflagrations.*

3-5.5 Protection

3-5.5.1 Automatic sprinkler protection should be installed in the all drying buildings or areas. Refer to Chapter 4.

3-5.5.1.1 Sprinkler protection is not recommended inside storage bins or silos.

3-5.5.2 In unheated buildings, pre-action sprinkler systems are preferable to dry sprinkler systems. This will minimize air discharge during initial operation and reduce the possibility of forming of a dust cloud during system operation

3-5.5.3 A standpipe system with hose connections should be provided at all operating levels in dried grain facilities. Since some of these areas are normally unheated, a dry standpipe system should be equipped with a remote control operating device at each hose station. Refer to Chapter 4 and NFPA 14, *Installation of Standpipe and Hose Systems.*

3-5.5.4 Dryers should be equipped with automatic high temperature limit controls. The high temperature limit control should be set about 50°F (28°C) above the normal operating temperature of the dryer. In addition, an independent safety shut down control circuit should be provided. This circuit should be arranged to shut down the dryer system in the event of:

a) Excess or over-temperature condition in the dryer;

b) Loss or shut down of supply or exhaust fans; or,

c) Burner flame failure.

3-5.5.5 Receiving bins should be provided at the dryer discharge. If a fire occurs in the dryer, this bin will allow the processed material to be intercepted and examined before it passes to main storage silos and tanks or other processing operations. Processed grain should be thoroughly cooled before storing or shipping

3-5.5.6 Where the dried grain processing operations are enclosed, a manually operated steam suppression (snuffing) system may be a practical additional method of protection.

3-5.5.7 Since distillers' dried grain is susceptible to spontaneous combustion, facilities with long term dried grain storage should consider installing a heat sensor system in the silos, storage tanks and bins to alert personnel of impending heat buildup. Temperatures should be measured and recorded at least every four hours. Wet grain materials should not be stored in silos, tanks or bins.

3-5.6 Electrics. Electrical equipment in dried grain handling buildings and areas should be designed for use in Class II, Group G hazardous locations. Refer to Chapter 6

3-5.7 Drainage. All dried grain silos and storage bins should be arranged to prevent sprinkler water or surface water entry. Moisture will swell dried grain, which may cause structural damage.

3-5.8 Ventilation (Dust Control)

3-5.8.1 Effective dust control is essential in dried grain operations. The dust collection system should provide adequate intake velocity at dust discharge points or near dust-producing equipment to capture escaping dust particles. Refer to NFPA 61, *Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities.*

3-5.8.2 A complete dust collection system should be provided with intakes at all dust emitting locations. This includes, but is not limited to, conveyor transfer locations, elevator legs, bin filling, discharge points; and at bagging operations.

3-5.8.3 Electrical interlocks should be provided to prevent operation of dust producing processes when the dust collection system is not operating.

3-5.8.4 Dust collection equipment should be located outdoors. If equipment is located indoors, it should be located at an outside wall and vented through the outside wall in accordance with current design practices. Refer to NFPA 68, *Venting of Deflagrations.* An alternate design would be installation of an explosion suppression system designed and installed in accordance with NFPA 69, *Explosion Prevention Systems.*

3-5.8.5 Enclosed dried grain processing equipment and conveying systems should be dust-tight and preferably operated under a negative pressure to minimize dust leakage.

3-5.9 Lightning Protection. Lightning protection should be provided for buildings or structures with dried grain handling operations. Refer to Section 6-4 "Lightning Protection".

3-5.10 Housekeeping

3-5.10.1 Good Housekeeping is an excellent safeguard for preventing dust explosions. Even with well-designed, dust-tight equipment, small amounts of dust will escape, accumulate and present a potential hazard unless removed at regular intervals.

3-5.10.2 Dust accumulations should be removed by any combination of

a) Vacuum Cleaning – Central systems are desirable and may prove to be more efficient. Small portable units are acceptable if the equipment is of the approved type. Refer to Chapter 7.

b) Soft Push brooms – This type of broom tends to minimize dust clouds when sweeping. They should not be used to remove dust from areas above the floor level. Pneumatic collector openings at floor level may be used to pickup sweepings. Clearance should be provided beneath and around equipment to permit sweeping or vacuum cleaning; or

c) Water spray may be used to wash equipment and buildings of combustible dusts.

3-5.10.3 Removal of deposits inside exhaust ducts should be performed on a regularly scheduled basis.

3-5.10.4 The use of compressed air to blow down dust accumulation should be avoided. This method can stir up large dust clouds. Devices utilizing compressed air in combination with continuous suction to remove dust as it is dislodged may be used where clearance is too close for other methods. Dust accumulation thickness should not exceed 1/8 inch (3mm) in depth.

3-5.11 Other Recommendations

3-5.11.1 Exteriors and interiors of conveyors and processing equipment should be accessible for inspection and maintenance.

3-5.11.2 The use of motion detection devices and bearing over temperature sensors are helpful in detecting conveying problems. This may help avoid jamming of conveyors and possibly creating an over temperature or fire situation. Consideration should be given to installation of these devices in conveyor design.

3-5.11.3 Conveying equipment should be equipped with detectors or interlock devices to identify jams, slow downs, or stoppage in any piece of equipment in the drying system. Activation of the devices should shut down all preceding equipment in the drying system as well as sound an alarm and initiate response from equipment operators.

3-5.11.4 Where practical, elevator enclosures should be extended without changes in size or direction to above roof level and provided with explosion-venting caps designed to relieve at 20 psi (138 kPa). For new installations, elevator legs should be located outside.

3-5.11.5 Conveyors and other process equipment should be electrically bonded and/or grounded and conveyor belts should be electrically conductive or equipped with static eliminators. Both types of static protection for conveyor belts should be considered. Refer to NFPA 77, *Static Electricity.*

3-5.11.6 Space heating equipment should have neither open flames nor any exposed surface with temperatures above 340°F (171°C).

3-5.11.7 Preventative maintenance programs should be established and maintained at dried grain facilities. These programs will help ensure equipment and systems receive proper and timely inspections and servicing.

3-5.11.8 Loss prevention programs are important to maintaining a fire safe location and should be established at dried grain facilities. Self-inspection programs should be conducted on a regular basis. A typical inspection report for a Grain Handling facility is provided in Appendix C. This form can be easily adapted for a dried grain facility.

3-5.11.9 Fumigation should be performed in accordance with procedures and practices contained in Annex C of NFPA 61, *Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities.* Refer to Section 8-2.4, "Fumigation".

3-6 ALCOHOL PROCESSING

3-6.1 General

3-6.1.1 For the purpose of this section, alcohol processing covers operations following distillation and up to the point of bottling, such as blending, gauging, agitating, filtering, barrel filling, and emptying barrels withdrawn from the warehouses after aging.

3-6.1.2 Solutions may be drawn from the distillation process with an alcohol content as low as 55% and as high as 97%. The alcohol solution normally remains at 55% or above throughout processing and is not reduced until just prior to bottling.

3-6.2 Occupancy

3-6.2.1 Various sized tanks are utilized in processing operations. Although some of these tanks are located outside, most are located within buildings.

3-6.2.2 Most processing operations are conducted in covered tanks with transfer through fixed piping or, in some cases, flexible metal reinforced hose. Some operations require alcohol transfer partially or wholly exposed to the surrounding area. Consequently, small spills are much more likely in areas such as barrel filling and draining.

3-6.2.3 Most tanks and processing equipment are in fixed locations; however, some smaller tanks and filters are portable.

3-6.3 Fire Development

3-6.3.1 Throughout the processing operations the alcohol solution can produce flammable vapors at room temperature, 70°F (21°C).

3-6.3.2 Hoses, piping, and fittings provide potential sources for leaks. Both hoses and tank gauge glasses are particularly subject to mechanical damage. Tank hatches left open can release vapors into the room.

3-6.4 Construction

3-6.4.1 Processing operations and tank rooms should be located in buildings of fire-resistive or noncombustible construction and should have a fire separation from other operations. Refer to Section 4-8, "Exposure Protection".

3-6.4.2 Processing operations and tank rooms should be located at or above grade level.

3-6.5 Protection. Automatic sprinklers should be provided throughout all processing areas. Refer to Chapter 4.

3-6.6 Electrics. The classification of electrical equipment within all processing areas will vary depending on its location. Refer to Chapter 6.

3-6.7 Drainage. Floor drainage is of considerable importance. Fires are more severe when adequate drainage is not provided. For proper drainage system design, refer to Section 5-6.4, "Interior Areas - Drainage and/or Containment Systems."

3-6.8 Ventilation. Ventilation should be provided (mechanically where necessary) to prevent accumulation of alcohol vapor from reaching 25% of the LFL. Refer to Section 5-7 "Ventilation".

3-6.9 Lightning Protection. Lightning protection should be provided for buildings and structures with alcohol handling operations. Refer to Section 6-4, "Lightning Protection".

3-6.10 Other Recommendations

3-6.10.1 Vapor detection systems may be considered for tank rooms that are unoccupied for long periods of time. Refer to Section 4-7, "Vapor Detection Systems".

3-6.10.2 To prevent the buildup of static electricity during alcohol transfer, bonding and grounding of tanks and equipment should be provided. Refer to Chapter 6.

3-6.10.3 A water supply with appropriate hose should be provided within tank rooms to permit washdown and dilution of alcohol spills.

3-6.10.4 Housekeeping within tank room areas is of prime concern. No storage should be permitted within the room.

3-7 BARREL WAREHOUSING

3-7.1 General

3-7.1.1 Certain distilled spirits, e.g., bourbons, whiskeys, scotches, and rums, are aged or matured in wooden barrels. Although the proof of the aging spirits is a business decision, generally it is between 110 to 160 proof (55% to 80% alcohol). The barrels are warehoused either standing on end on wood pallets or in barrel rack warehouses lying on their sides in either steel, timber, or steel and timber racks.

3-7.1.2 Barrel rack warehouses are designed for multi-tiered racks of barrels lying on their sides. Figures 1-1, 1-2 and 1-3 depict three commonly used multi-tiered barrel rack configurations – single, double, and multi-row. Also, wood dunnage (stick racking), rather than barrel racks, is sometimes used.

3-7.1.3 One-story rack warehouses with barrels tiered more than twelve high are sometimes divided at intervals by false floors as draft stops.

3-7.1.4 Walls, false floors and/or the roof of a one-story rack warehouse may be supported by the racks.

3-7.1.5 Multi-story rack warehouses generally contain multi-tiered racks of barrels six to nine high between stories.

3-7.1.6 Palletized barrels are stacked up to six pallet levels high in palletized warehouses.

3-7.2 Occupancy

3-7.2.1 In rack warehouses, barrels are usually rolled on metal runs between the point of warehouse entry/withdrawal and the racking machine. Racking machines are used to enter and withdraw barrels from the tiers above floor level. The barrels are manually rolled into or out of position within the racks. Either freight elevators or barrel conveyors are used to enter and withdraw the barrels from multi-storied and from multi-tiered one-story false floored rack warehouses.

3-7.2.2 Palletized barrels are transported by slow moving conveyors designed specifically for that purpose and/or industrial lift trucks.

Pallets of barrels are stacked one on top of the other by an industrial lift truck. Refer to Section 7-1.4, "Industrial Trucks" for industrial lift truck type and class information.

3-7.2.3 Distilled spirits in metal and plastic drums should not be stored in barrel warehouses. Refer to Section 3-13, "Storage of Distilled Spirits in Metal and Plastic Drums".

3-7.3 Fire Development

3-7.3.1 Significant spills are rare but may occur when one or more barrels fall during handlings.

3-7.3.2 If an alcohol spill is ignited, it can involve the barrels, racks and pallets. Fire may spread horizontally and vertically through "flues". When automatic sprinklers are not provided, the barrels' metal hoops may expand permitting the contents to leak, fueling the fire. Palletized stacks may collapse, spilling barrel contents, and fueling the fire.

3-7.3.3 Fire development in multiple-row racks is more difficult to control than in either single-row or double-row racks. The lack of interior catwalks results in many, very narrow slots between barrels. Thus, obstruction to the penetration of sprinkler water is greater than for either single-row or double-row racks.

3-7.3.4 Unlike timber racks, steel racks cannot directly contribute fuel to a fire. However, steel failure can occur causing barrels to fall.

3-7.4 Construction

3-7.4.1 Barrel warehouses may be of either combustible or noncombustible construction. Construction types depend upon exposure distances and fire protection. Wood, steel, or steel and wood racks are acceptable. Refer to Section 4-8, "Exposure Protection" and NFPA 80A, *Protection of Buildings From Exterior Fire Exposures.*

3-7.4.2 In rack warehouses, structural stability, height of racks, and probable barrel loading patterns should be considered.

3-7.4.3 Fire separation should be considered for limiting fire loss of barrel warehouses. If there is exposure from other buildings, masonry walls with parapets should be considered. Refer to Section 4-8, "Exposure Protection".

3-7.5 Protection. Automatic sprinkler protection should be provided in barrel warehouses, especially if the warehouse is a possible fire exposure to other buildings, structures or operations, on or off the property. Refer to Chapter 4.

3-7.6 Electrics

3-7.6.1 The main electric circuit breaker or disconnect switch to barrel warehouses should be located exterior to the warehouse. Electrics should be turned off at the main circuit breaker or disconnect switch when power is not required for operational reasons.

3-7.6.2 Refer to Chapter 6 and Chapter 7 for additional electrical information.

3-7.7 Drainage. For proper drainage system design, refer to Section 5-6.4, "Interior Areas - Drainage and/or Containment Systems."

3-7.8 Ventilation. Ventilation should be provided (mechanically where necessary) to prevent accumulation of alcohol vapor from reaching 25% of the LFL. Refer to Section 5-7 "Ventilation." The possibility of localized pockets of vapor should be considered.

3-7.9 Lightning Protection. Lightning protection should be provided for barrel warehouses. Refer to Section 6-4, "Lightning Protection".

3-7.10 Barrel Repair

3-7.10.1 A small percentage of barrels develop leaks in either the staves, stave joints, heads, or head joints. Although frequency of occurrence is much more prevalent in the bourbon industry (barrels are being used for the first time for maturing bourbon), it can occur regardless of the spirits being matured or how many times the barrels have been used. Generally, the leaks have no fire development significance, however, some distillers choose to repair all barrel leaks.

3-7.10.2 In racks, leaks are often repaired by manually turning the barrel so that the point of leakage is above the liquid line. Wood material is then wedged or driven into the leak source. The leaking barrel should be marked so it will not be reused for aging distilled spirits.

3-7.10.3 If the leak is significant, or is likely to become significant, and cannot be rotated to above the liquid line, the barrel should be removed from the rack for major repair or for emptying at a location away from the racked barrels.

3-7.10.4 Palletized barrels are more difficult to leak-hunt and repair. Generally, insignificant leaks are neither discovered nor repaired.

3-8 BARREL FILL AND DRAIN OPERATIONS

3-8.1 General

3-8.1.1 Barrel fill and drain operations are an integral part of spirits processing. Certain spirits are introduced into wooden barrels for aging, and after completion of the aging period removed from the barrel for further processing.

3-8.1.2 Barrel Fill

3-8.1.2.1 Certain spirits after distillation (55% to 80% alcohol) are introduced into wooden barrels prior to aging.

3-8.1.2.2 Distilled spirits are generally conveyed by pumping through fixed piping from the distillery to tanks in the barrel filling area. Spirits are then held in tanks until introduction into barrels.

3-8.1.2.3 Transfer of spirits from a tank to a barrel is conducted through fixed piping and/or flexible hose.

3-8.1.2.4 Several filling methods are employed in the barrel filling operation. These methods include: manual, semi-automatic and automatic filling. Either pneumatic or electronic instrumentation may be utilized to control liquid volume in the barrel.

3-8.1.2.5 After filling, the barrel is date stamped and coded with information to provide an audit trail for future reference. Barrels are then transported to a warehouse for further handling and aging.

3-8.1.3 Barrel Drain

3-8.1.3.1 Upon completion of the spirit aging process, barrels are removed from the warehouse and transported to the drain area for emptying.

3-8.1.3.2 Several methods are used to empty barrels. In the "Dump Trough" method, barrels travel on a conveyor over a trough to drain. This method utilizes gravity flow from the barrel through the trough to a holding tank; the spirits are then transferred to processing operations. Another method of removal is direct pumping from the barrel and transfer to processing operations. This method may be either semi, or fully automatic.

3-8.1.3.3 After the barrel is drained, a small amount of water may be sprayed into the barrel and then drained to remove residual alcohol from the char and barrel.

3-8.2 Occupancy

3-8.2.1 Barrelfill and drain operations should be separated from processing and warehousing operations.

3-8.2.2 Conveyance of spirits from or into the barrel can generate alcohol vapors that can be within the flammable range in the immediate area of operations.

3-8.2.3 Each area contains barrel conveyors, tanks, piping, pumps and either barrel filling or draining equipment.

3-8.2.4 Removal and repair of damaged barrels may be done in this area.

3-8.3 Fire Development

3-8.3.1 In general, alcohol vapors escaping from the fill and drain operations, usually limited to the barrel area, are of sufficient strength to be within the flammable range at room temperature.

3-8.3.2 Barrels filled with alcohol provide the potential for leaks and spills during handling. Leaks should be repaired and spills contained or diluted and cleaned up to eliminate a potential fire hazard.

3-8.4 Construction

3-8.4.1 Fill and drain operations should be located in buildings of fire resistive or noncombustible construction.

3-8.4.2 These operations should be separated from other occupancies by open space or a minimum two (2) hour fire rated construction. Refer to Section 4-8 "Exposure Protection".

3-8.5 Protection. Automatic sprinklers should be provided throughout the fill and drain operational areas. Refer to Chapter 4 for design recommendations.

3-8.6 Electrics. Electrical equipment in the fill and drain operation areas should be designed for Class 1, Group D locations. Refer to Chapter 6 for recommended distances for locating and selecting equipment for use in the areas.

3-8.7 Drainage. Drainage should be provided in the immediate fill and drain operational area. For proper drainage system design, refer to Section 5-6.4, "Interior Areas - Drainage and/or Containment Systems".

3-8.8 Ventilation. Ventilation should be provided (mechanically where necessary) to prevent accumulation of alcohol vapor from reaching 25% of the LFL. Refer to Section 5-7 "Ventilation".

3-8.9 Lightning Protection.
Lightning protection should be provided for buildings and structures with alcohol handling operations. Refer to Section 6-4, "Lightning Protection".

3-8.10 Other Recommendations

3-8.10.1 To prevent the possibility of static electricity discharge during operations, all spirit tanks, piping, pumps and equipment should be electrically bonded and grounded. Refer to Section 6-3, "Static Electricity".

3-8.10.2 A water supply with hose connection should be provided in each area to permit dilution and washdown of incidental alcohol spills.

3-8.10.3 Proper housekeeping within the fill and drain areas is important. No unnecessary storage should be permitted within either area.

3-9 Empty Wooden Barrel Storage

3-9.1 General. Empty barrels (new and used) are stored both inside and outside of buildings. They are stored either stacked on end, one on top of the other, palletized, or on their sides in piles in a pyramid fashion.

3-9.2 Occupancy

3-9.2.1 Used barrels, regardless of storage location (inside or outside of buildings) should be treated as a Class IV commodity as defined in NFPA 13, *Installation of Sprinkler Systems.*

3-9.2.2 New barrels should be treated as a Class III commodity as defined in NFPA 13, *Installation of Sprinkler Systems.*

3-9.2.3 The maximum dimensions of an empty barrel configuration stored outside should be based upon safe operational accessibility. Clearance between the configurations should be at least 25 feet.

3-9.2.4 Fire department apparatus access to outside empty barrel storage areas should be provided. Access should include an all weather surface driveway which is a least 15 feet wide and capable of supporting fire department apparatus.

3-9.2.5 Distances from building and outdoor storage of empty barrels should be in accordance with Table 3-9.2.5.

Table 3-9.2.5
Outdoor Storage of Used Barrels

Height, feet (m)	Distance b/w Storage and Noncombustible Building Walls, feet (m)*
Up to 10 (3)	25 (7)
Over 10 (3)	50 (15)

* Where the adjacent building is of combustible construction or has non-rated walls or unprotected openings, the distances shown should be doubled. Barrels should not be stored in areas designated as clear space for exposure protection.

3-9.3 Fire Development

3-9.3.1 Fires in either new or used barrel storage can be difficult to control unless the configuration is properly protected. All configurations create horizontal and vertical flues. This facilitates spreading of a fire throughout the array, while hampering penetration of water to the fire.

3-9.3.2 Used barrels can be expected to burn with extreme rapidity. They may contain alcohol vapors in the explosive range. If the vapors are exposed to fire, the barrel may explode. The barrels should be stored with bungs installed to prevent ignition of alcohol vapors within the barrels.

3-9.4 Construction. Buildings in which empty barrels are stored may be of either combustible or noncombustible construction.

3-9.5 Protection. Automatic sprinkler protection should be provided in buildings utilized for indoor storage of used or new empty wooden barrels. Exterior barrel storage areas should be located so they are accessible by fire protection apparatus. Refer to Chapter 4.

3-9.6 Electrics. For new barrel indoor storage areas, ordinary electrics are considered acceptable. For used barrel indoor storage areas, electrics should be listed for use in accordance with the classification of the area in which they are stored. Refer to Chapter 6.

3-9.7 Drainage. Not applicable.

3-9.8 Ventilation. Not applicable.

3-9.9 Lightning Protection. If used barrels are stored in buildings, lightning protection should be provided. Refer to Section 6-4 "Lightning Protection".

3-10 Storage of Empty Bottles and Packaging Materials

3-10.1 General. Although storage of empty bottles in cartons and other dry goods are considered an ordinary hazard, there are recommendations and considerations relative to the distilling industry.

3-10.2 Occupancy. Occupancy may include palletized stacks, racked palletized storage, and slip sheet stacked materials.

3-10.3 Fire Development

3-10.3.1 Fire loading can include corrugated and chipboard cartons, wood pallets, paper labels, stamps, boxes, and slip sheets, and plastic materials such as bottle closures and wrapping.

3-10.3.2 Other fire development considerations include, but are not limited to electrical industrial truck-charging stations, industrial trucks, and maintenance or welding area hazards.

3-10.4 Construction. The building should be of fire-resistive or noncombustible construction and should have fire separation from other operations. Refer to Section 4-8, "Exposure Protection".

3-10.5 Protection. Automatic sprinkler protection should be provided. Refer to Chapter 4.

3-10.6 Electrics. Ordinary electrical equipment is considered acceptable.

3-10.7 Drainage. Ordinary industrial drainage is considered adequate.

3-10.8 Ventilation. Normal building ventilation is considered adequate, except for operations such as the charging of electric industrial equipment, where appropriate ventilation should be provided. Refer to Section 7-1.4.4, "Industrial Trucks".

3-11 BOTTLING

3-11.1 General. The bottling area consists of packaging of various spirit products for consumer use. The products are transferred through piping systems and may be packaged in glass or plastic bottles or metal cans. Sometimes the containers are covered individually with or packaged in special or holiday wrappings. The containers are then placed in cartons, which may be encapsulated.

3-11.2 Occupancy. In the bottling area, machinery is employed for bottle cleaning, filling, capping, labeling, inspecting, and packing. The bottling room may contain supplies of empty bottles in cartons, as well as caps, labels, adhesives, advertising attachments, and federal and state stamps. The cartoned product is usually moved to a warehouse for finished case goods.

3-11.3 Fire Development. Fires occurring in bottling operations may result from ignition of a small alcohol spill or accumulation of cartons or paper materials.

3-11.4 Construction. The bottling area should be of noncombustible or fire-resistant construction and should have fire separation from other operations. Refer to Section 4-8, "Exposure Protection".

3-11.5 Protection. Automatic sprinkler protection should be provided. Refer to Chapter 4.

3-11.6 Electrics. The classification of electrical equipment within the bottling area will vary depending on its location. Refer to Chapter 6.

3-11.7 Drainage. Drainage to a safe location should be provided at container filling machines to minimize the possibility of ignition of a spill.

3-11.8 Ventilation. Particular attention should be given to the areas surrounding the container filling machines to ensure that alcohol vapors do not reach 25% of the LFL. Generally, normal building ventilation will accomplish this objective

3-11.9 Lightning Protection. Lightning protection should be provided for buildings and structures with alcohol handling operations. Refer to Section 6-4, "Lightning Protection".

3-11.10 Other Recommendations

3-11.10.1 All tanks and associated equipment should be installed in accordance with Section 3-5, "Alcohol Processing", and Chapter 5.

3-11.10.2 Cardboard cartons and waste material must not be permitted to accumulate. Combustible waste material and residues in the building should be kept at a minimum, stored in closed metal waste cans, and disposed of daily. Refer to Section 8-3.5, "Rubbish and Trash Handling"

3-12 STORAGE OF FINISHED CASE GOODS

3-12.1 General. After being packaged for the consumer, the finished case goods are stored awaiting shipment. Finished case goods represent the highest dollar value to the manufacturer.

3-12.2 Occupancy. Finished case goods may be stored in solid piles, on wood pallets, on slip sheets, or in either wood or metal racks.

3-12.3 Fire Development. Fire development considerations include, but are not limited to, breakage resulting in spillage of the product, stacked case goods, empty pallet stacks, plastic wrap, vapors from charging areas for electric industrial trucks, industrial trucks, cutting and welding operations, and maintenance supply storage.

3-12.4 Construction. The building should be of fire-resistive or noncombustible construction and should have fire separation from other operations. Refer to Section 4-8, "Exposure Protection".

3-12.5 Protection. Automatic sprinkler protection should be provided. Refer to Chapter 4.

3-12.6 Electrics. Ordinary electrical equipment is considered acceptable. Refer to Chapter 6.

3-12.7 Drainage. Ordinary industrial drainage is considered adequate.

3-12.8 Ventilation. Normal building ventilation is considered acceptable, except for operations such as the charging of electric industrial equipment, where appropriate ventilation should be provided. Refer to Section 7-1.4.4, "Industrial Trucks".

3-13 STORAGE OF DISTILLED SPIRITS IN METAL AND PLASTIC DRUMS

3-13.1 General. Distilled spirits or alcohol based flavors often are stored in drums or totes constructed of metal or plastic. The behavior of drums in a fire is significantly different than the behavior of wooden barrels containing spirits.

3-13.2 Occupancy. Drums containing distilled spirits or alcohol based flavors may be stored in "Inside Storage Rooms", "Cutoff Rooms and Attached Buildings", "General Purpose Warehouses", or "Liquid Warehouses" as defined in NFPA 30, *Flammable and Combustible Liquids Code.*

3-13.3 Fire Development. Metal drums exposed to fire can BLEVE, unless they are fitted with approved means of venting. Plastic drums exposed to fire may melt, releasing their contents and further fueling the fire.

3-13.4 Construction. The building or room as defined in Section 3-13.2, "Occupancy" should be constructed as defined in NFPA 30, *Flammable and Combustible Liquids Code.*

3-13.5 Protection. Automatic sprinklers should be provided. Refer to Chapter 4 and NFPA 30, *Flammable and Combustible Liquids Code.*

3-13.6 Electrics. Proper electrical equipment should be provided in these areas. Refer to Chapter 6 and NFPA 30, *Flammable and Combustible Liquids Code*

3-13.7 Drainage. Refer to Section 5-6.4, "Interior Areas - Drainage and/or Containment Systems".

3-13.8 Ventilation. Ventilation should be provided (mechanically where necessary) to prevent accumulation of alcohol vapor from reaching 25% of the LFL. Refer to Section 5-7, "Ventilation".

3-13.9 Lightning Protection. Lightning protection should be provided for buildings and structures with alcohol storage operations. Refer to Section 6-4, "Lightning Protection".

3-13.10 Other Recommendations. Only approved drums shall be used as specified in NFPA 30, *Flammable and Combustible Liquids Code.*

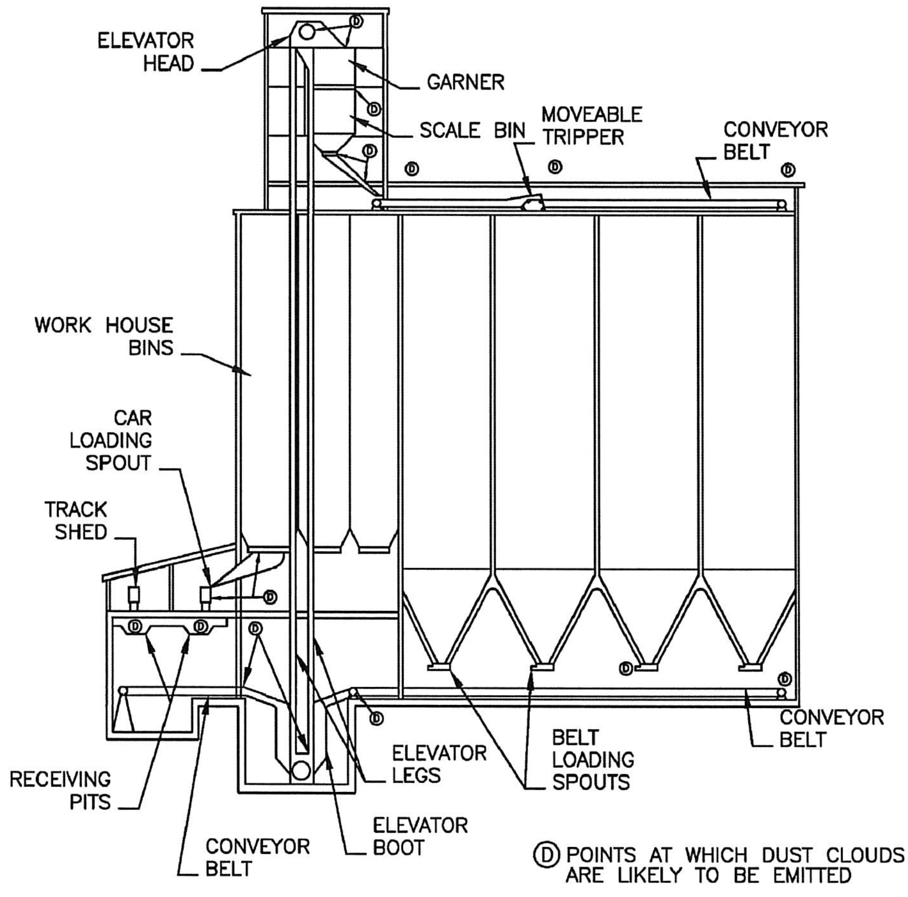


Figure 3-1.2 Sectional Diagram of a Terminal-Type Grain Elevator

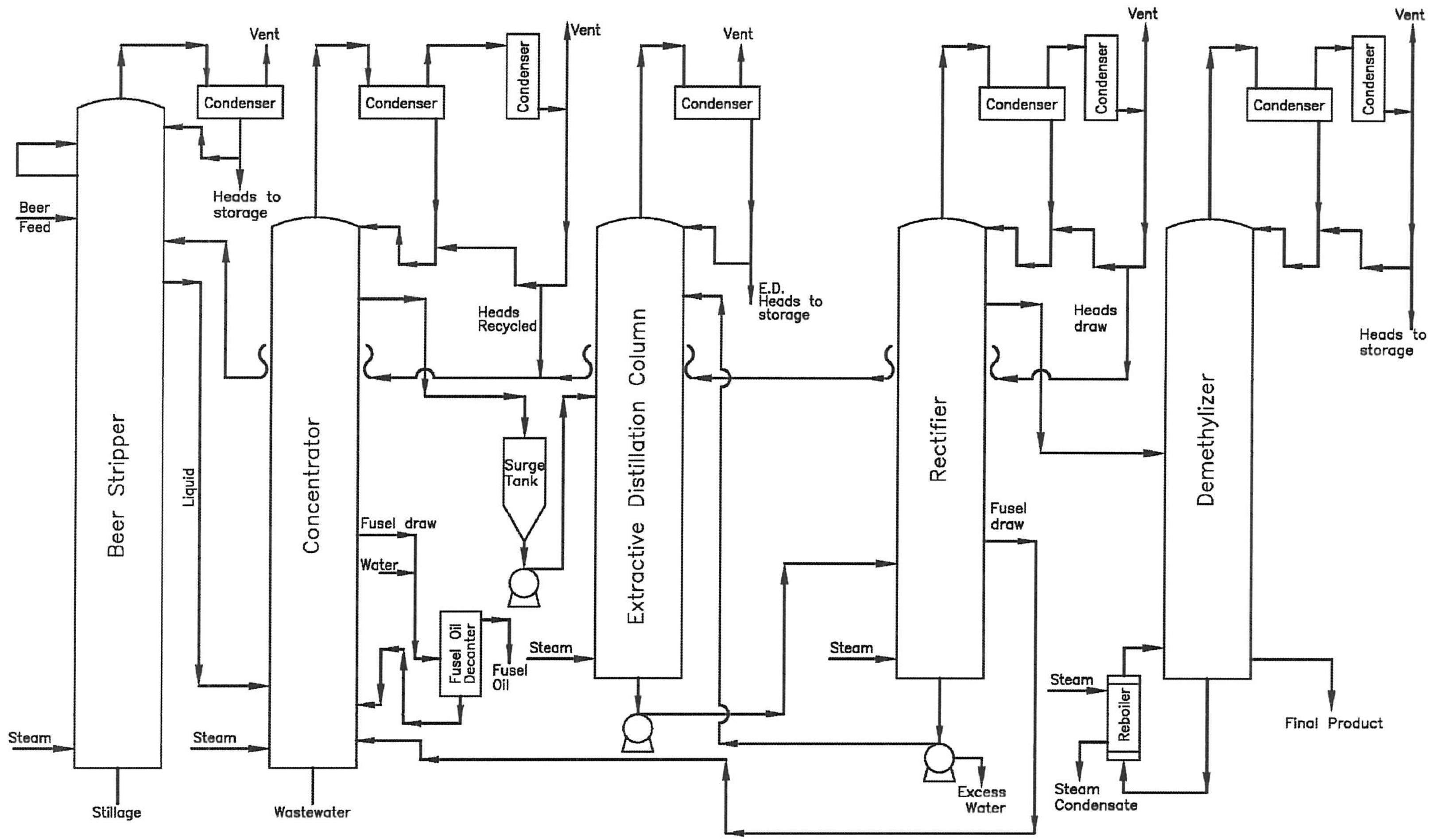


Figure 3-1.4a Typical Column Distillery Process for Alcohol Distillation

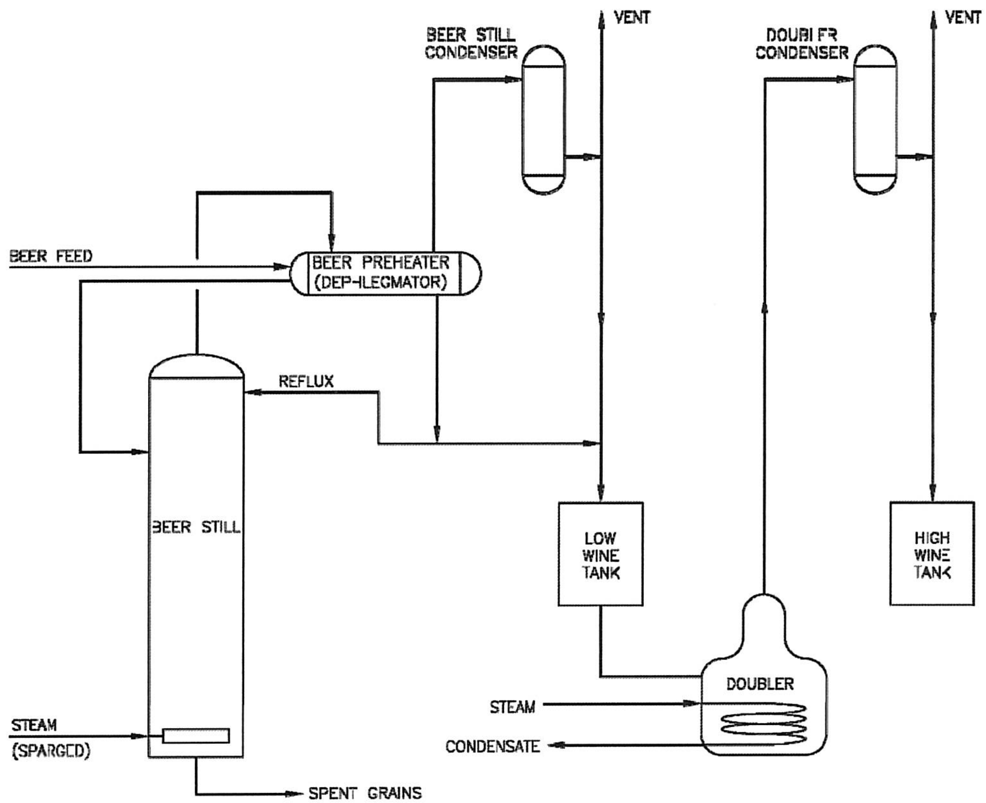


Figure 3-1.4b Bourbon Whiskey Distillation with Doubler

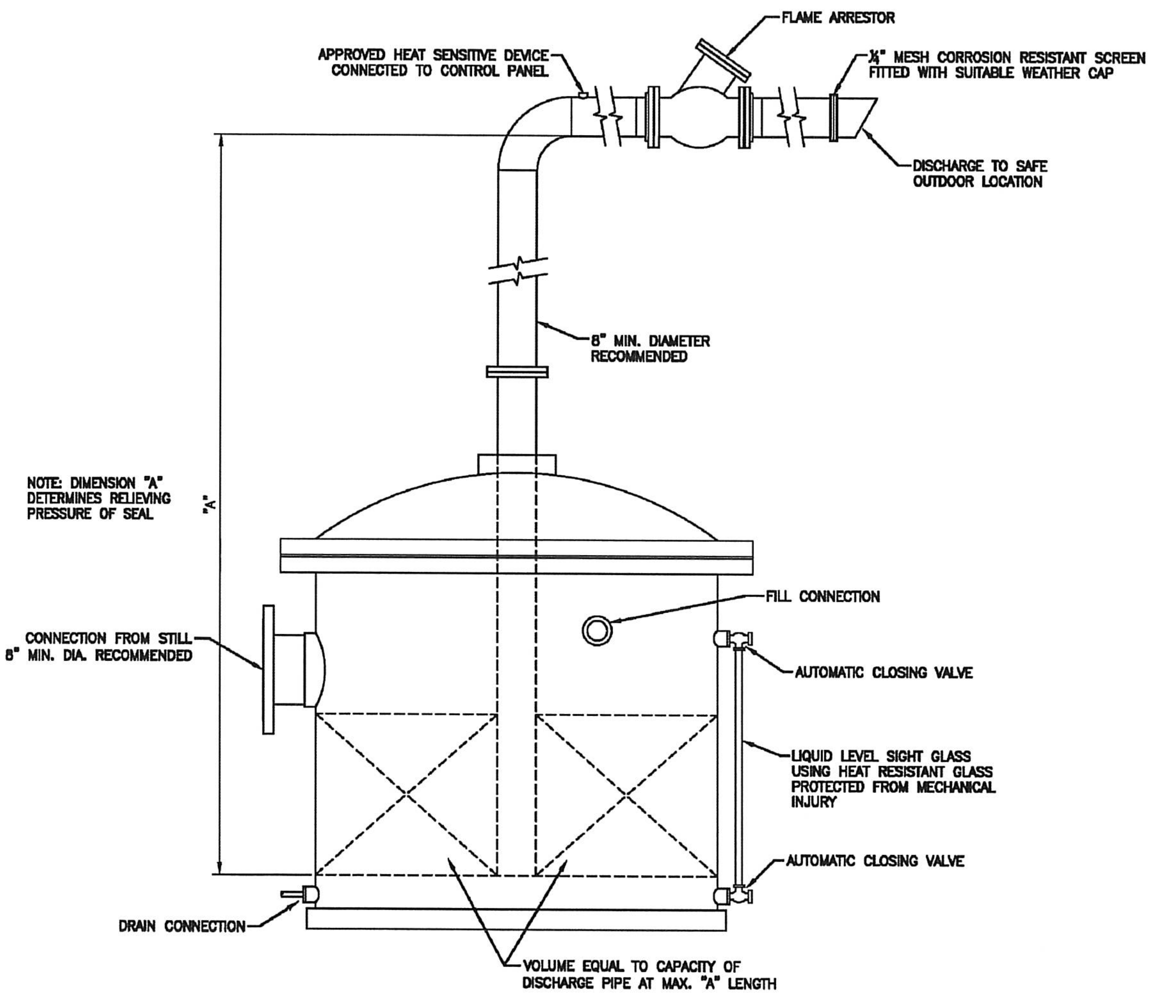


Figure 3-4.10.2 Pressure/Vacuum-Relieving Seal Pot

Chapter 4
Protection Practices

4-1 GENERAL

4-1.1 Outside fire protection equipment should be provided for manual fire-fighting operations. Public and/or private hydrants should afford this protection. Hydrants should be installed at intervals of not more than 300 (90m) feet apart. Protection for multiple tank installations (tank farms) can be provided via methods such as master streams, as delivered by fixed monitor nozzles or hydrant mounted monitor nozzles. Refer to NFPA 24, *Installation of Private Fire Service Mains and Their Appurtenances.*

4-1.2 Inside fire protection equipment should be provided for manual fire-fighting operations.

4-1.2.1 Listed fire extinguishers should be provided in all areas. In barrel warehouses, it is acceptable to have one appropriately sized fire extinguisher at each exit per floor level. Refer to NFPA 10, *Portable Fire Extinguishers.*

4-1.2.2 In areas where conditions require the provision of inside hose, it should be 1½-inch (38mm), listed fire hose, with shutoff and combination solid stream and water spray nozzles. Smaller diameter, listed hose, may be used if acceptable to the authority having jurisdiction. Hose stations should be installed and maintained. Refer to NFPA 14, *Installation of Standpipe, Private Hydrant, and Hose Systems* and NFPA 1961, *Fire Hose*.

4-2 SPRINKLER AND WATER SPRAY PROTECTION

4-2.1 Where automatic sprinkler systems are installed, they should be in accordance with NFPA 13, *Installation of Sprinkler Systems*, or NFPA 15, *Water Spray Fixed Systems for Fire Protection*, or both, except as modified herein. Wet pipe sprinkler systems are preferred in all areas.

4-2.2 Sprinkler design criteria for each specific occupancy should be in accordance with Tables 4-2.2a to 4-2.2e.

4-2.3 Where clearance between sprinkler deflectors and the top of storage is greater than 10 ft., special designs should be considered.

4-2.4 Sprinklers should be provided under all obstructions (including grating) greater than four feet wide

4-2.4.1 Water shields should be provided above lower level sprinklers to prevent cooling of the fusible elements by discharge from the overhead sprinklers. Sprinklers such as intermediate level or rack storage models that incorporate a built-in shield comply with this requirement. Alternatively, a water shield may be provided with minimum dimensions at least four times as large as the vertical distance between the fusible element and the shield.

4-3 EXPLOSION PROTECTION

4-3.1 For sprinkler and water-spray systems in buildings or structures subject to potential explosive hazards, installation practices should incorporate features to protect the systems from damage due to an explosion.

4-3.2 Risers should be located in cut-off areas, with pressure resistant walls, or shielded by structural columns.

4-3.3 Feed and cross mains should be located away from equipment that could explode. The mains should be located in aisles or off to the side.

4-3.4 Water supply arrangements to hazardous areas should be buried, looped, and equipped with additional valves (divisional and control) so any potential explosion damage can be isolated. Main shutoff and sprinkler control valves should be located at least 50 ft. (15 m) from a building or structure.

4-3.5 Welding of pipe connections or use of welded flanged fittings should be considered to lessen damage to piping systems from an explosion.

4-3.6 Protection systems piping should be supported from the building or structural framework.

4-4 WATER SUPPLIES

4-4.1 Water supplies should be designed to meet anticipated sprinkler and hose stream demands for the recommended duration. See Section 4-5, "Water Demand". The supply may be provided by public water, gravity tanks, pressure tanks, suction tanks, booster pumps, fire pumps, and private water source, or any combination thereof. Secondary or multiple supplies should be considered.

4-4.2 Public Water One or more connections to a reliable public water system of adequate pressure, volume, and capacity may furnish an adequate supply. Adequacy of the water supply should be determined by flow tests or other reliable means. Refer to NFPA 24, *Installation of Private Fire Service Mains and Their Appurtenances*.

4-4.3 Fire Pumps

4-4.3.1 Where public water supply, volume or pressure, is inadequate for fire protection purposes, diesel or electric fire pumps should be installed as appropriate. Refer to NFPA 20, *Installation of Stationary Pumps for Fire Protection.*

4-4.3.2 Pump houses and pump rooms should be of fire-resistive or noncombustible construction. Where exposed fuel storage tanks for internal combustion engines used for driving fire pumps are located inside the fire pump house or pump room, protection for the area should be provided by automatic sprinklers. Refer to Section 4-2, "Sprinkler and Water Spray Protection."

4-4.3.3 Fire pumps should start automatically by a drop in water pressure (preferred) or other acceptable arrangement. Where two or more electrically driven fire pumps are supplied from the same electrical feeder, they should incorporate a sequential timing device to prevent simultaneous starting, which could cause circuit overloading.

4-4.3.4 Frequent, unnecessary starting of fire pumps should be avoided by the installation of a small auxiliary pressure-maintenance (jockey) pump or other suitable means to maintain normal system pressure.

4-4.3.5 Once started, fire pumps should be arranged to run continuously until they are stopped manually. There should be an audible pump running alarm in a constantly attended location.

4-4.4 Tanks

4-4.4.1 Elevated gravity tanks and pressure tanks may be satisfactory sources; however, their limited pressure or volume makes them less desirable than other arrangements. When gravity or pressure tanks are to be used, the authority having jurisdiction should be consulted. Refer to NFPA 22, *Water Tanks for Private Fire Protection.*

4-4.4.2 When a sufficient water supply is not available for fire pumps, suction tanks and reservoirs are an alternative. Refer to NFPA 22, *Water Tanks for Private Fire Protection.*

4-4.5 Fire Department Connections

4-4.5.1 One or more fire department connections (Siamese) should be installed where it can be utilized to supplement all water-based fire protection systems. Refer to NFPA 13, *Installation of Sprinkler Systems*, or NFPA 24, *Installation of Private Fire Service Mains and Their Appurtenances*.

4-4.5.2 Where there are natural bodies of water, provisions should be made to enable the fire department to perform drafting operations if necessary. Provisions may include a suction connection complete with strainers (dry hydrant) or an all-weather ramp capable of supporting the weight of fire apparatus.

4-4.6 Other Sources It is sometimes acceptable to use water supplies for both fire protection and process purposes. Proper provisions should be made to ensure an adequate and reliable supply is retained for fire protection.

4-5 WATER DEMAND

4-5.1 Total water demand for each water based protection system should include the demands of 1) ceiling sprinklers, 2) intermediate level sprinklers, if applicable (in-rack, below tanks and/or under catwalks and grating), and 3) hose stream demand as specified in Tables 4-2.2a, 4-2.2b, and 4-2.2e.

4-5.2 Minimum water supply duration should be four hours. Inadequate separation distance between buildings, lack of drainage system, high insurable values, critical nature of operations, and many other factors may make it advisable to extend the duration. The authority having jurisdiction should be consulted when contemplating additional water supply duration.

4-6 OTHER EXTINGUISHING SYSTEMS

4-6.1 Foam-Water sprinkler or spray systems may be considered in instances where the need is indicated by the potential hazards of storage or exposure. Foam-Water systems can be used to control or suppress flammable liquid pool fires and prevent the spread of burning flammable liquids. This may reduce needs for containment or spill control. The authority having jurisdiction should be consulted to discuss protection criteria when foam-water systems are contemplated. Refer to NFPA 11, *Low-, Medium-, and High- Expansion Foam*; *and* NFPA 16, *Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.*

4-6.2 Specialized extinguishing systems, such as dry chemical, carbon dioxide, clean agents, or self-contained extinguishing units, can provide an improved level of protection in areas with increased potential hazards or at locations without a water supply for water based protection systems. Provision of these systems should be considered where the potential hazards or exposures warrant their installation. The authority having jurisdiction should be consulted when these systems are contemplated. Refer to NFPA 12, *Carbon Dioxide Extinguishing Systems;* NFPA 17, *Dry Chemical Extinguishing Systems;* NFPA 2001, *Clean Agent Fire Extinguishing Systems.*

4-7 ALARM SYSTEMS AND WATCH SERVICE

4-7.1 Fire and evacuation alarm systems should be considered for each facility. Operations involve the production and handling of flammable alcohol along with utilization and storage of other combustible materials. These alarm systems will help with timely identification and notification of potential fire or other emergencies and will facilitate a quicker response by both private and public emergency services (fire, police, etc.). These systems also provide a mechanism to notify all personnel of the need to evacuate the buildings or area. Building, fire, or life safety codes or fire authorities may mandate installation of these systems. Refer to NFPA 72, *National Fire Alarm Code* and NFPA 101, *Life Safety Code.*

4-7.2 Proper installation of fire alarm system components, such as automatic fire detectors (smoke, heat, optical, etc.), manual activation devices, waterflow switches, alarm notification appliances, control panels etc., is critical to their satisfactory operation. Installation, testing and acceptance of the components and systems should conform to industry standards and practices. Refer to NFPA 72, *National Fire Alarm Code* and NFPA 101, *Life Safety Code.*

4-7.3 All fire alarm system wiring, initiating devices, detectors, alarm appliances, etc., should be listed for use in accordance with the classification of the area in which they are installed. Refer to NFPA 72, *National Fire Alarm Code and* NFPA 70, *National Electric Code.* Refer to Chapter 6.

4-7.4 Monitoring (supervision) of the fire alarm systems is an important feature to consider for any facility. Options include utilizing a listed Central Station service, a proprietary system, remote station system, direct connection to local emergency services, etc. Factors which may influence which form of monitoring is chosen depend on local availability of a competent central station service, 24 hour operation of a facility, guard or security service availability, etc. as well as the potential hazards of and exposures to the operations. Refer to NFPA 72, *National Fire Alarm Code.*

4-7.5 Watch service / guard service may be considered at a facility. Through periodic rounds and tours, a watch service can become aware of potential adverse situations or conditions and initiate a timely response. When watch service is provided, refer to NFPA 601, *Security Services in Fire Loss Prevention.*

4-8 EXPOSURE PROTECTION

4-8.1 The evaluation of exposure protection for structures or operations requires consideration of a number of variables such as the fire load of the structure or operation, the size of the exposed or exposing area or structure, distance separation between areas, drainage capabilities, potential direction of flammable liquid flows, types of construction, fire department response, water supplies, impact on operations, and insurable values. None of the above can be considered by itself, but each must be considered in relation to the others. Refer to NFPA 80A, *Protection of Buildings from Exterior Fire Exposure* to perform an analysis to determine safe separation distances and/or necessary exposure protection arrangements.

4-8.2 Access routes for emergency responders and fire apparatus and sufficient operating space, should be available for manual fire fighting efforts at all structures. The potential radiant heat from a fire situation should be considered when developing these routes or establishing the operating space. Improved roads capable of supporting fire department apparatus should provide access to all structures on the property. The access roads should be at least 20 feet (6 m) wide and have a minimum vertical clearance of 13.5 feet (4 m). Access roads should normally have a grade of 10 percent or less. Steeper grades are allowable, if acceptable to the authority having jurisdiction. Dead-end roads in excess of 300 feet (91 m) should have turnarounds at the terminus. This terminus should have a minimum radius of 50 feet (15 m) to the centerline.

4-8.2.1 Primary access routes may become blocked or impassable, due to a fire situation at a structure. This might prevent access to the fire situation from an opposite direction or to other remote structures on the property. Where this situation exists, a secondary access route should be considered to facilitate alternate access to the fire situation or the other structures on the property.

4-8.3 A clear space free of combustible vegetation (forest, trees, brush, scrub, etc.) and other combustible materials will help reduce or minimize the potential fire exposure to structures. For details refer to Section 8-3.3, "Yard Exposures".

Table 4-2.2a
Process Occupancies[1]

Occupancy	Type of Sprinkler System		Density gpm/ft² (mm/min)	Area of Demand ft² (m²)	Hose Stream Demand gpm (L/min)
Grain Handling (including drying)	Protect in accordance with NFPA 13 for Ordinary Hazard Group 2 occupancy (with a suggested minimum design area of 2000 ft² (186 m²).				
Mashing and Fermenting[2]	Wet		0.20 (8)	2000 (186)	250 (950)
	Dry		0.20 (8)	2600 (242)	250 (950)
Still House	Wet or Dry		0.20 (8)	5000 (465) first level 2000 (186) intermediate and ceiling levels	500 (1900)
Barrel Fill and Drain Areas	Wet or Dry		0.25 (10)	5000 (465)	500 (1900)
Barrel Warehousing	See Tables 4-2.2c, 4-2.2d and 4-2.2e				
Tanker Loading, Unloading Station	Deluge/Water Spray		0.25 (10)	Simultaneous operation of all sprinklers (see NFPA 15)	500 (1900)
Tank Rooms[3]	Wet or Dry	165°F	0.30 (12)	5000 (465)	500 (1900)
		286°F	0.30 (12)	4000 (372)	500 (1900)
Bottling Areas	Wet		0.20 (8)	3000 (279)	500 (1900)
	Dry		0.20 (8)	5000 (465)	500 (1900)
Cooperage	Protect in accordance with NFPA 13 for Ordinary Hazard Group 2 occupancy (with a suggested minimum design area of 2000 ft² (186 m²).				

1 For use with sprinkler temperature ratings between 165°F and 286°F (74°C-141°C), unless otherwise noted.

2 Minimum of 600 gpm (2300 L/min) sprinkler demand at base of riser in accordance with NFPA 13 requirements for Ordinary Hazard occupancy.

3 Sprinklers should be provided beneath all tanks with a horizontal dimension greater than 4 feet (1.2m). Design should be based on an end head pressure of 15 psi (100 kPa). Sprinklers provided under any solid or grated catwalks should be designed to provide a density of 0.15 gpm per ft² (6 mm/min). The overall tank room design should consider the simultaneous operation of ceiling, under tank, and under catwalk sprinklers within the area of demand specified above.

Table 4-2.2b
Storage Occupancies[1]

Occupancy	Container Type[2]	Storage Height	Type of Sprinkler System	Density gpm/ft^2 (mm/min)	Area of Demand ft^2 (m^2)	Hose Stream Demand gpm (L/min)
Finished Case Goods						
1. Solid Pile / Palletized	Glass or PET Plastic	20 feet or less	Wet Dry	0.30 (12) 0.30 (12)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
	Glass or PET Plastic	20 – 25 feet	Wet Dry	0.40 (16) 0.40 (16)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
2. Racked	Glass	Any	- Protect in accordance with NFPA 13 for a Class III Commodity[3]			500 (1900)
	PET Plastic	Any	- Protect in accordance with NFPA 13 for a Class IV Commodity[3]			500 (1900)
Empty Bottles						
1. Solid Pile / Palletized	Glass	Any	- Protect in accordance with NFPA 13 for a Class I Commodity[3]			500 (1900)
	PET Plastic[5]	20 feet or less	Wet Dry	0.30 (12) 0.30 (12)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
	PET Plastic[5]	20 – 25 feet	Wet Dry	0.40 (16) 0.40 (16)	3000 (279) 4000 (372)	500 (1900) 500 (1900)
2. Racked	Glass	Any	- Protect in accordance with NFPA 13 for a Class I Commodity[3]			500 (1900)
	PET Plastic[5]	Any	- Protect in accordance with NFPA 13 for a Class IV Commodity[3]			500 (1900)
Dry Goods[4, 5]	- Protect in accordance with NFPA 13 as appropriate for the commodity[3]					500 (1900)
Empty Barrels and Idle Pallet Storage Exterior or Interior	- Protect in accordance with NFPA 13 as appropriate[3] for the commodity Treat empty NEW barrels as a Class III commodity Treat empty USED barrels as a Class IV commodity					Exterior: 1000 (3800) Interior: 500 (1900)

1 For use with sprinkler temperature ratings between 165°F and 286°F (74°C – 141°C), unless otherwise noted
2 Applies to storage of glass or plastic (PET) containers, in corrugated cartons
3 Suggested minimum design area should be 2000 ft^2 (186 m^2) for wet systems and 2600 ft^2 (242 m^2) for dry pipe systems
4 Where applicable, ESFR sprinkler systems may be installed in accordance with NFPA 13
5 Plastic closures and 50 ml PET plastic bottles are treated as granular plastic, and protected in accordance with NFPA 13 (as a Class IV commodity)

Table 4-2.2c
Sprinkler Protection Design Requirements for Single-Row and Double-Row, Racked Storage of Distilled Spirits in Barrels

Number of Tiers of Barrels between Floor and Ceiling[3]	Sprinkler Design Criteria[1,2] (sprinkler temperature ratings between 165°F – 286°F [74°C – 141°C], both wet and dry systems)							
	Ceiling Only		Ceiling with In-Racks One Level[4]		Ceiling with Level Under Bottom Barrel (Jamieson or Burke System)[5, 8]		Ceiling with In-Racks At Each Catwalk Level (Diamond Stagger System)[6, 8]	
	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)	Density gpm/ ft² (mm/min)	Area of Application ft² (m²)
0 – 6	0.22 (9)[7]	4000 (372)						
7 – 9	0.30 (12)	4000 (372)						
10 – 12	0.40 (16)	3000 (279)						
13 – 15	0.50 (20)	3000 (279)	0.30 (12)	4000 (372)	0.35 (14)	3000 (279)	0.22 (9)	2000 (186)
16 – 18			0.40 (16)	3000 (279)	0.50 (20)	3000 (279)	0.22 (9)	2000 (186)
19 – 21			0.40 (16)	3000 (279)	0.50 (20)	3000 (279)	0.22 (9)	2000 (186)
22 – 24			0.40 (16)	3000 (279)	0.55 (22)	3000 (279)	0.22 (9)	2000 (186)

1 Hose stream demand is not required.

2 Where there is a sloping roof, the sprinkler on each line closest to the eaves may have less than 18 inches (450 mm) clearance.

3 Where draft floors are provided every sixth tier vertically, protection requirements for 0-6 barrels may be used.

4 Design of in-rack sprinklers should be based on the simultaneous operation of the most hydraulically remote 6 sprinklers at a minimum operating pressure of 30 psi (2 bar). Refer to Figures 4-2.2a and 4-2.2b.

5 Design of sprinklers under bottom barrels is based on a discharge density of 0.15 gpm / ft² t (6 mm/min) over the hydraulically most remote 2,500 ft² (232 m²). Refer to Figure 4-2.2c.

6 Design of in-rack sprinklers is based on the simultaneous operation of the most hydraulically remote 10 sprinklers (5 on each two top levels) at a minimum operating pressure of 30 psi (2 bar). Refer to Figure 4-2.2d.

7 It is permissible to have a sprinkler clearance less than 18 inches (450 mm) providing the discharge density is increased by 0.01 gpm/ ft² (0.4 mm/min) for each 1 inch (25 mm) reduction in sprinkler clearance.

8 The Jamieson/Burke and Diamond Stagger systems are old style systems. Information is provided for reference only. New installations should not utilize these designs.

Table 4-2.2d
Sprinkler Protection Design Requirements for Multiple-Row, Racked Storage of Distilled Spirits in Barrels

Number of Tiers of Barrels between Floor and Ceiling	Sprinkler Design Criteria[1,2] (sprinkler temperature ratings between 165°F – 286°F [74°C – 141°C], both wet and dry systems)			
	Ceiling with In Racks for Every Six-Barrel Tiers[3]		Ceiling with Level Under Bottom Barrel (Jamieson or Burke System)[4, 5]	
	Density gpm / ft^2 (mm/min)	Area of Application ft^2 (m^2)	Density gpm /ft^2 (mm/min)	Area of Application ft^2 (m^2)
0 – 6	0.30 (12)	4000 (372)	---	---
7 – 24	0.35 (14)	3000 (279)	---	---
7 – 15	---	---	0.50(20)	4000 (372)

1 Hose stream demand is not required.

2 Where there is a sloping roof, the sprinkler on each line closest to the eaves may have less than 18 inches (450 mm) clearance.

3 Design of in-rack sprinklers should be based on the simultaneous operation of the most hydraulically remote:

a. Eight sprinklers when only one level installed.
b. Fourteen sprinklers (seven on each of the two top levels) when more than one level is installed.

A minimum operating pressure of 30 psi (207 kPa) shall be provided at any sprinkler in the racks. Refer to Figure 4-2.2e.

4 Design of sprinklers under bottom barrels is based on a discharge density of 0.15 gpm / ft^2 (6 mm/min) over the hydraulically most remote 2,500 ft^2 (232 m^2). Refer to Figure 4-2.2c.

5 The Jamieson/Burke system is an old style system. Information is provided for reference only. New installations should not utilize this design.

Table 4-2.2e
Recommended Criteria in Automatic Sprinkler Design for up to Six-High, Palletized Barrel Storage of Spirits[1]

	Units					
Temperature Rating of Sprinklers	°F (°C)	165 (74)		286 (141)		Hose Stream Demand ---
Type of System	---	Wet	Dry	Wet	Dry[2]	
Design Point 1						
Density	gpm/ ft² (mm/min)	0.35 (14)	*	0.35 (14)	0.35 (14)	
Area of Application	ft² (m²)	7500 (697)		4000 (372)	4000 (372)	500 gpm 1900 L/min)
Design Point 2[3]						
Density	gpm/ ft² (mm/min)	0.20 (8)	*	0.20 (8)	0.20 (8)	None Required
Area of Application	ft² (m²)	12500 (1,162)		10000 (929)	12500 (1,162)	
Duration of Demand	Hours	4	---	4	4	---

* Not tested and not recommended.

1 Densities based on clearance of 18 in. to 10 ft. (450 mm to 3 m) with area per sprpinkler coverage from 80 ft² to 100 ft² sq ft (7.4 m² to 9.3 m²).
2 Minimum of one quick opening device (QOD) required. Second QOD suggested.
3 This second design point not required when storage is four or less pallet levels in height (wet systems only).

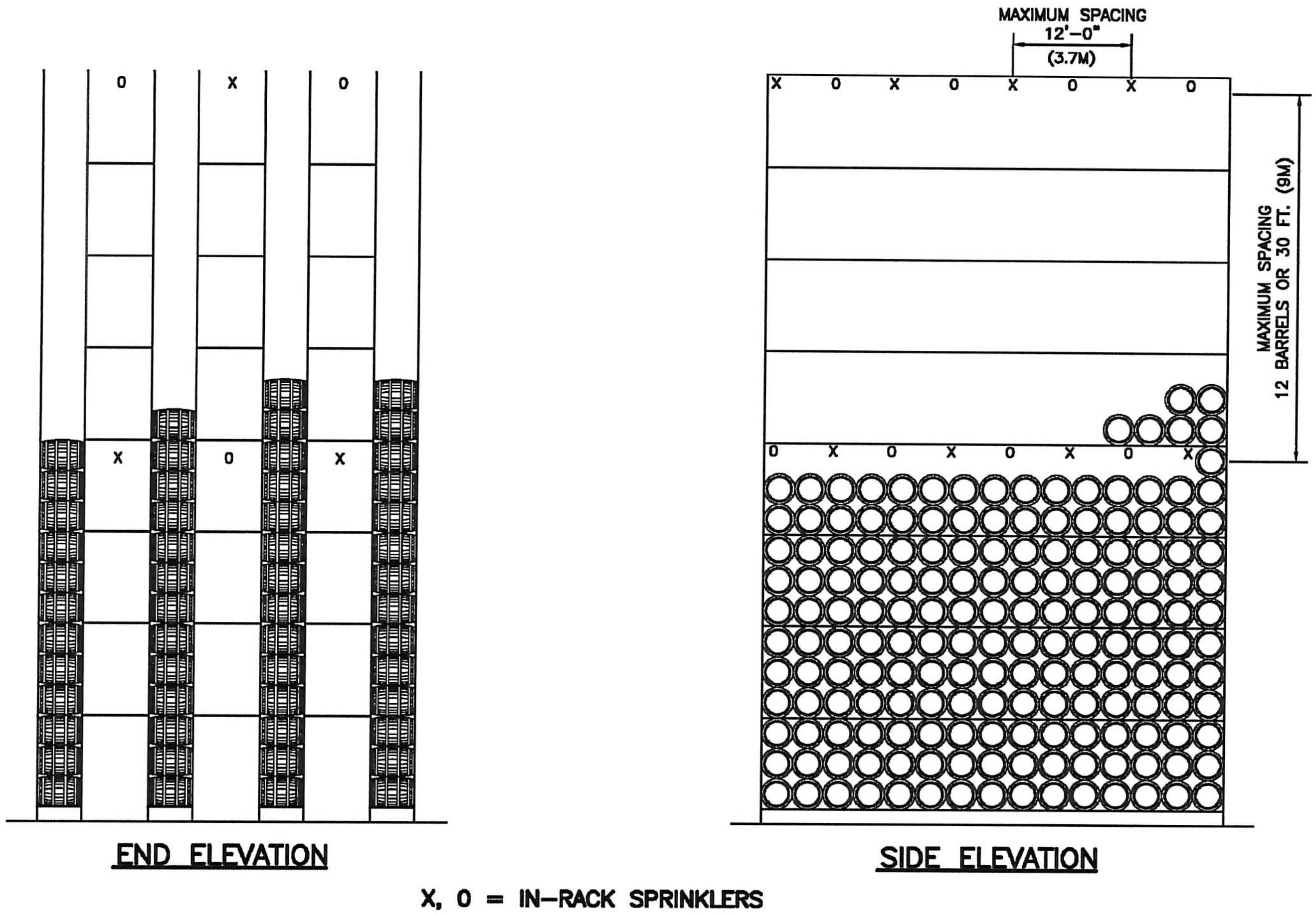


Figure 4-2.2a Single-Row Racks. Location of In-Rack Sprinklers

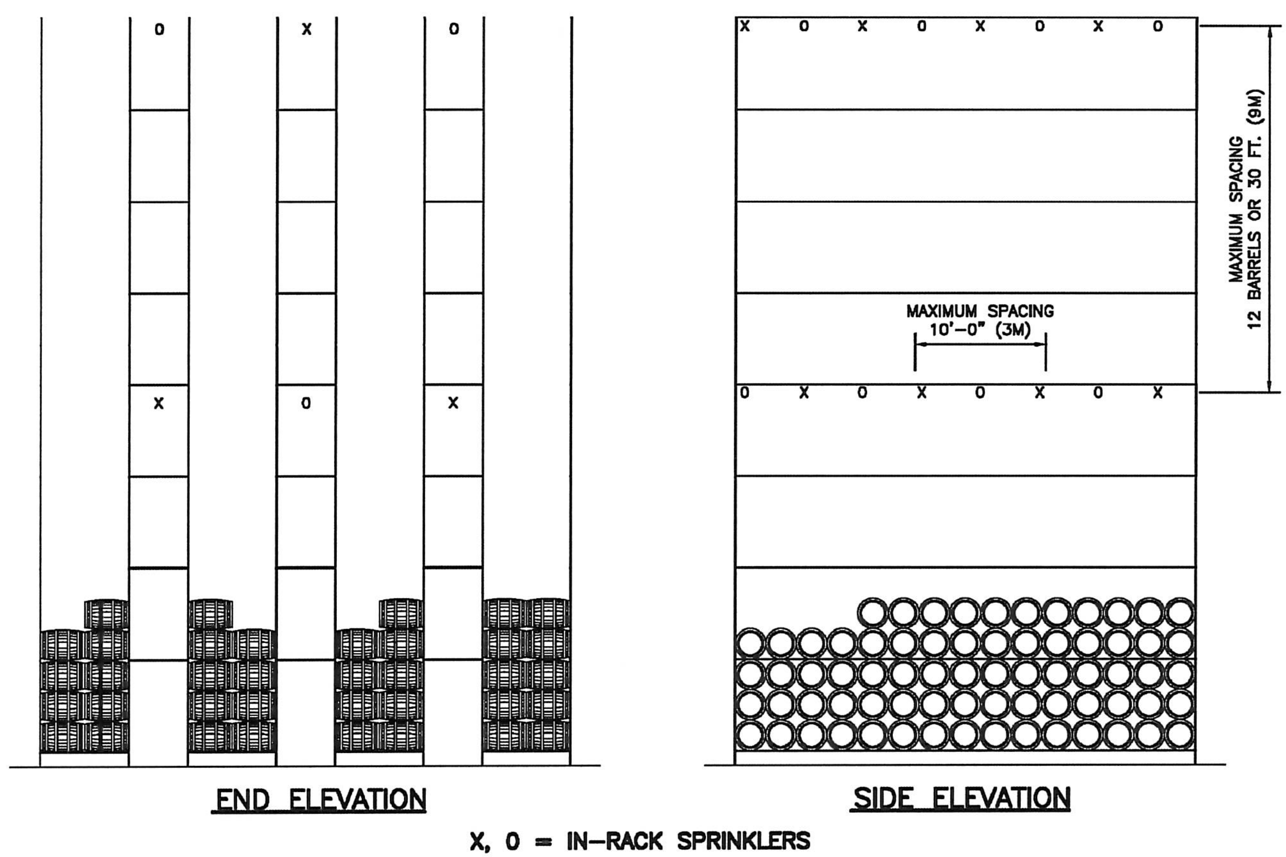


Figure 4-2.2b Double-Row Racks. Location of In-Rack Sprinklers

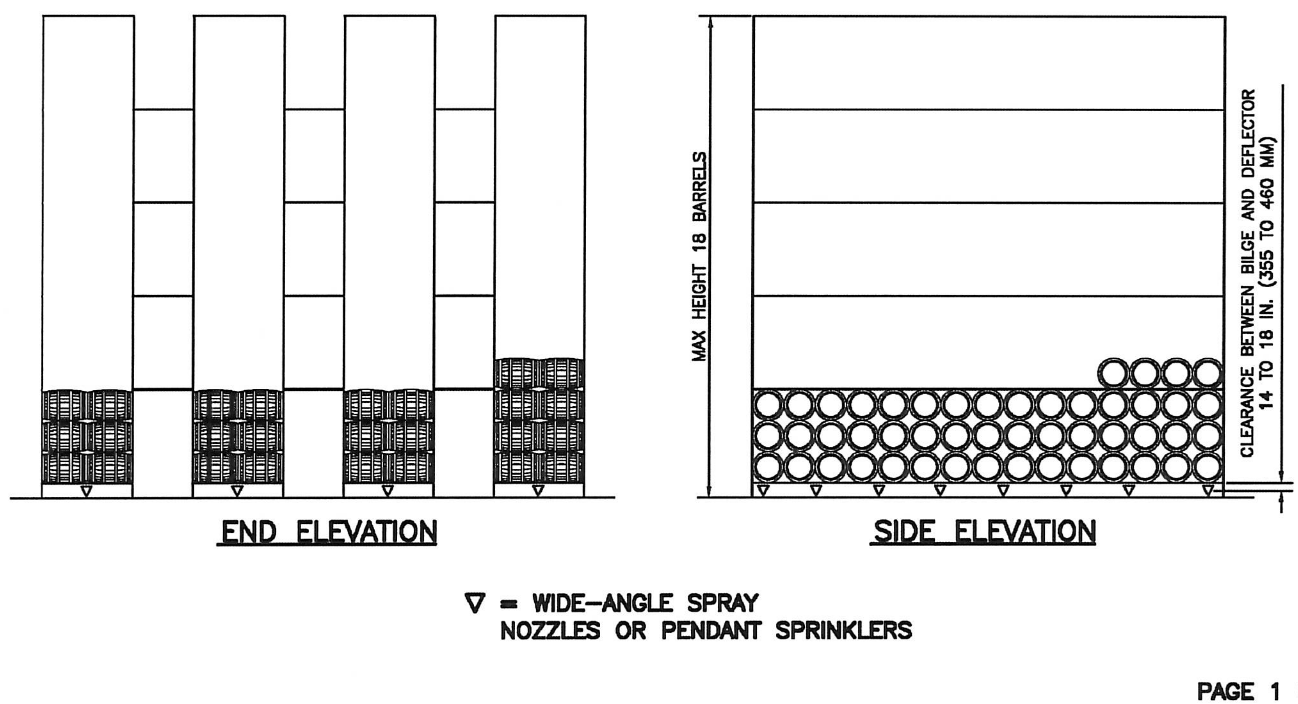
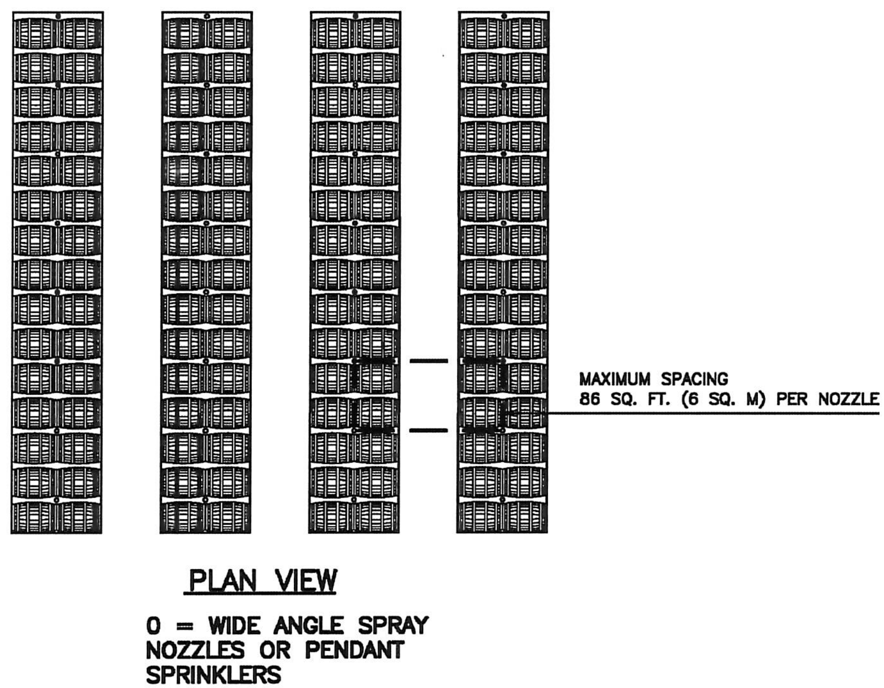
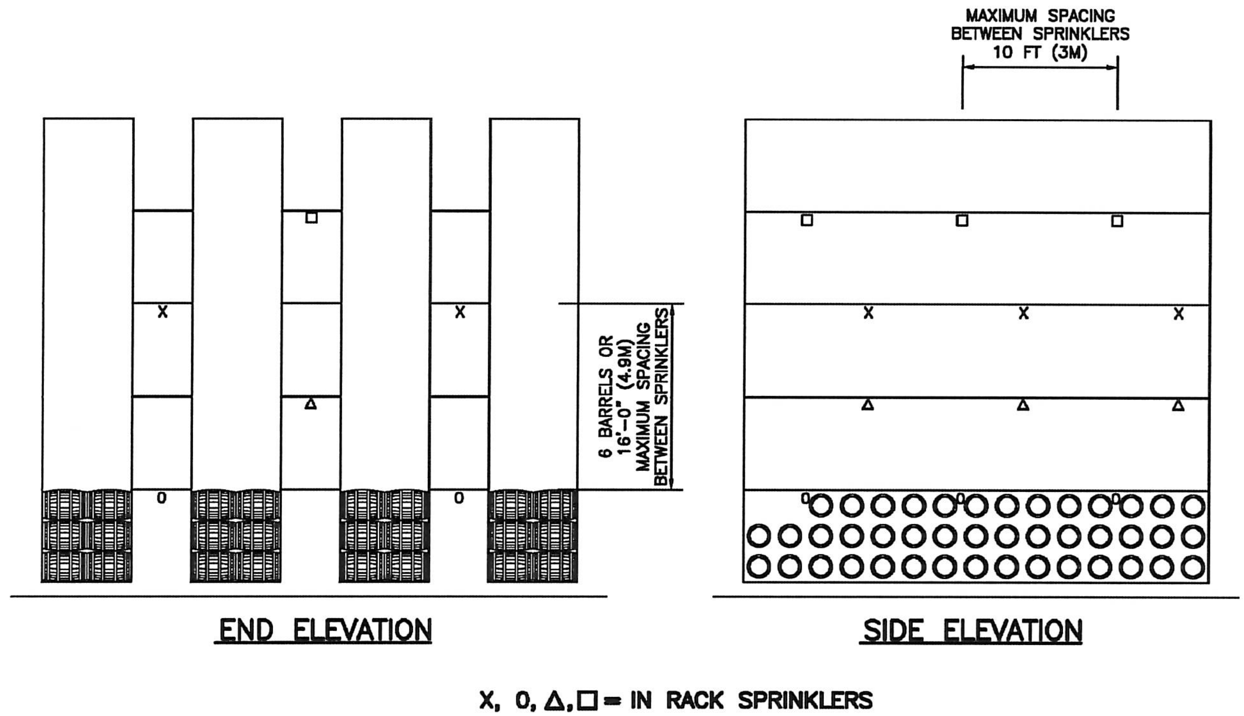


Figure 4-2.2c-1 Double-Row Racks. Location of Sprinklers Under Bottom Barrels. (Jamieson or Burke System)



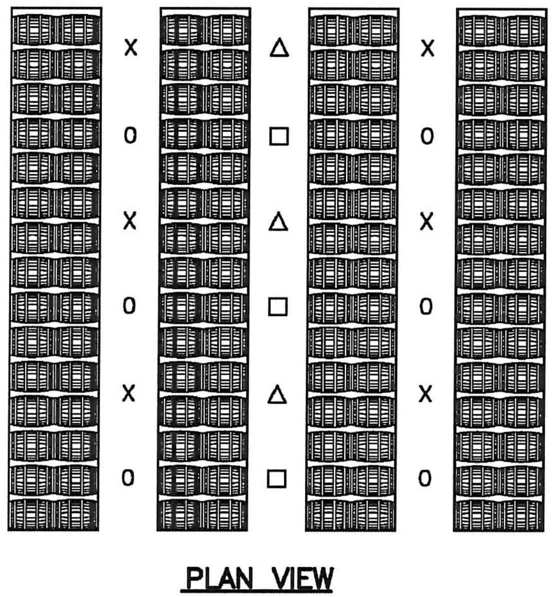
PAGE 2 OF 2

Figure 4-2.2c-2 Double-Row Racks. Location of Sprinklers Under Bottom Barrels. (Jamieson or Burke System)



PAGE 1 OF 2

Figure 4-2.2d-1 Double-Row Racks. Location of In-Rack Sprinklers at Each Catwalk Level (Diamond Stagger System)



X, O, Δ, □ = IN RACK SPRINKLERS

PAGE 2 OF 2

Figure 4-2.2d-2 Double-Row Racks. Location of In-Rack Sprinklers at Each Catwalk Level (Diamond Stagger System)

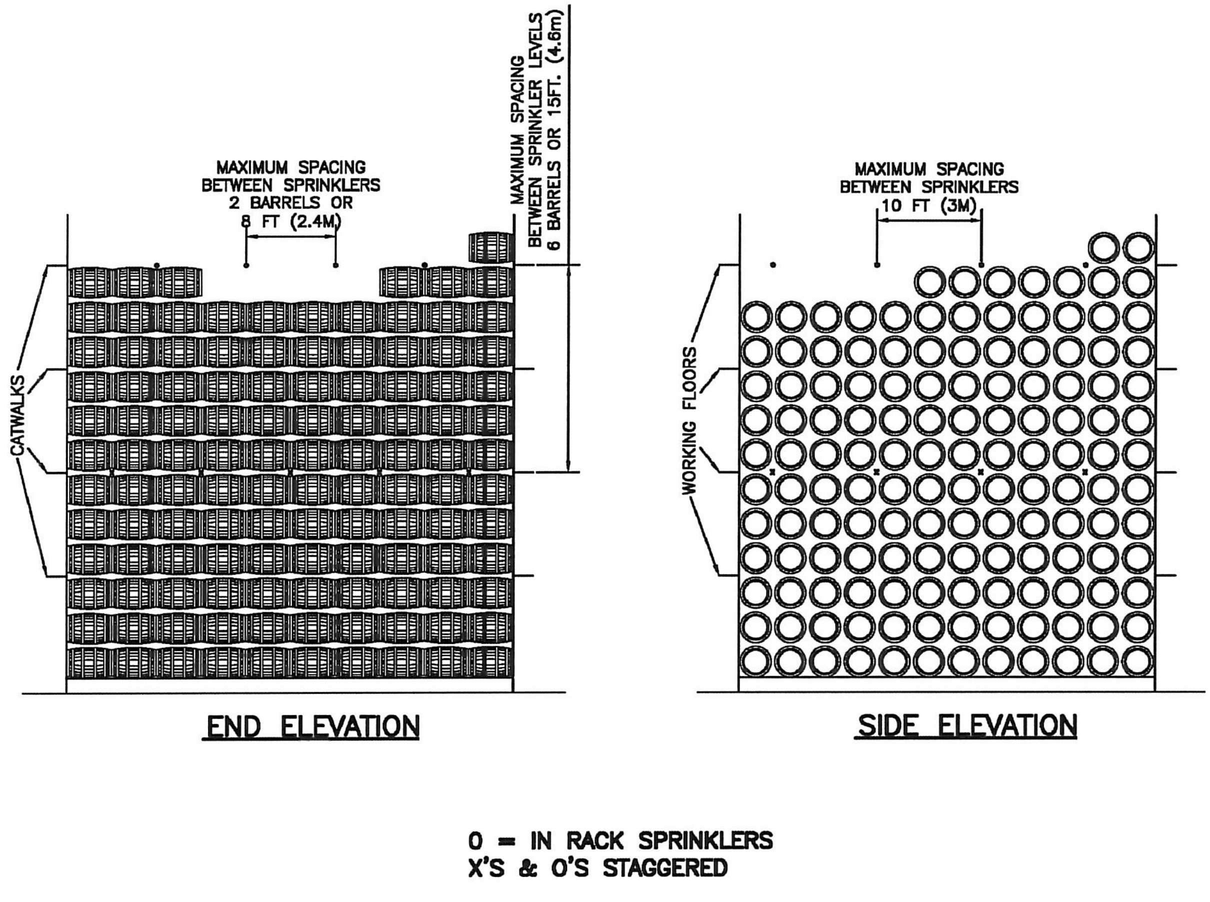
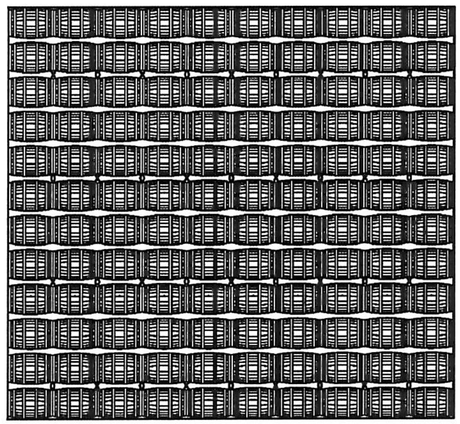


Figure 4-2.2e-1 Multiple-Row Racks. Location of In-Rack Sprinklers



PLAN VIEW

X, 0 = IN-RACK SPRINKLERS

PAGE 2 OF 2

Figure 4-2.2e-2 Multiple-Row Racks. Location of In-Rack Sprinklers

Chapter 5
Alcohol Handling

5-1 GENERAL

5-1.1 Alcohol handling is done in a closed-type system, which includes tanks, fixed and movable piping, and facilities for vehicle loading and unloading. This chapter provides basic specifications for construction, design, location, venting, drainage, and protection of tanks containing over 1,000 gallons (3800 L.).

5-2 TANK DESIGN AND CONSTRUCTION

5-2.1 Materials. Tanks should be constructed in accordance with recognized engineering standards for the construction material being used.

5-2.2 Design. Tank design and construction should meet the requirements of NFPA 30, *Flammable and Combustible Liquid Code,* except as modified by this Guideline.

5-2.2.1 An additional pressure across the flame arrester/conservation vent occurs when overflowing out the vent. All of these should be taken into account to prevent possible tank failure from overflow. Hydrostatic testing at this total pressure should be done to verify that the tank can adequately withstand the required pressures.

5-2.2.2 The vent pipe(s) should terminate close enough above the level of the tank to avoid imposing a dangerous liquid head on the tank should the liquid overflow through the vent. The maximum pressure on the bottom of the tank should be calculated by multiplying the vertical distance (in feet) from the bottom of the tank to the top of the vent pipe by 0.433 psi/ft.[9.8 kPa/m] (This is based on the use of the tank for products with a specific gravity less than or equal to 1 [water]).

5-2.2.3 The normal operating pressure of the tank should not exceed the design pressure of the tank. However, when calculating the design pressure of any tank, the head pressure of the vent pipe should be considered as part of the normal operating pressure. Refer to Section 5-3, “Tank Venting”.

5-2.2.4 If a tank has a rupture disk installed in the vent stack, the pressure required to rupture the disk should be calculated as part of the tank’s normal operating pressure.

5-2.3 Tank Supports, Foundations, and Anchorage.

5-2.3.1 Tanks should rest on foundations or pilings made of concrete, masonry, or steel. Tank foundations should be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation. Refer to API Standard 620, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks.*

5-2.3.2 When tanks are supported above the foundations, tank supports should be installed on firm foundations. Supports should be of concrete, masonry, or protected steel. Steel may be protected by fire proofing materials or sprinklers. Wood timber supports are not recommended.

5-2.3.3 The design of the supporting structure for tanks requires special engineering consideration. Refer to Appendix N of the API Standard 620, *Recommended Rules of the Design and Construction of Large, Welded, Low-Pressure Storage Tanks.*

5-2.3.4 Every tank should be supported to prevent excessive concentration of loads on the supporting portion of the shell.

5-2.3.5 Where a tank is located in an area that may be subjected to flooding, refer to NFPA 30, *Flammable and Combustible Liquids Code.*

5-2.3.6 In areas subject to earthquakes, the tank supports and connections should be designed to resist significant damage.

5-2.4 Testing

5-2.4.1 Prior to use, all tanks, whether shop-built or field-erected should be tested in accordance with the requirements of NFPA 30, *Flammable and Combustible Liquid Code*, except as modified by this Guideline.

5-2.4.2 All tanks and associated connections should be tested for tightness with water. All leaks or deformations should be corrected in an acceptable manner. Mechanical caulking should not be permitted for correcting leaks in welded tanks.

5-2.4.3 Tanks normally operating at pressures below their design pressure should be tested, based upon the pressure developed under full emergency venting of the tank.

5-3 TANK VENTING

5-3.1 Tank venting is required to allow normal filling and emptying of the tank, thermal expansion and contraction and emergency venting due to exposure to an external fire. This venting should not be construed as supplying emergency venting for an internal vapor ignition.

5-3.2 Normal breathing and emergency venting may be accomplished with one vent designed for the dual function. If two separate vents are used, the emergency venting requirements may be reduced by the venting capacity of the normal breathing vent.

5-3.3 Normal tank breathing requirements should be calculated as follows;

a) For out-breathing provide 1 cubic foot of air per hour for every 3.5 gallons per hour of maximum filling rate (1 m^3/hr free air for each 0.47 m^3/hr). In addition, add to this the thermal venting capacity (pressure) shown in Table 5-3.3;

b) For in-breathing provide 1 cubic foot of air per hour for each 7.5 gallons per hour of maximum emptying rate (1 m^3/hr free air for each 1 m^3/hr). In addition, add to this the thermal venting capacity (vacuum) indicated in Table 5-3.3. Light gauge tanks with conservation vents may implode if the pallets in the vent do not open well below the suction pressure created by discharging from the tank. Therefore, it is extremely important that these be designed, installed, and maintained properly.

5-3.3.1 The cross-sectional area of the breather vent should be greater than or equal to total cross-sectional areas of the discharge, or fill connections, whichever is larger.

5-3.4 When entire dependence for emergency relief is placed upon pressure relieving devices, the total venting capacity of both normal and emergency vents should be enough to prevent rupture of the shell or bottom of the tank if vertical, or of the shell or heads if horizontal. The total capacity of both normal and emergency venting devices should not be less than that calculated in Section 5-3.5, "Tank Venting".

5-3.5 To determine the Emergency Venting Requirements, the following procedure should be used:

a) Calculate the "wetted area" for the tank or storage vessel utilizing the following factors:

   1. 55% of the total exposed area of a sphere or spheroid;

   2. 75% of the total exposed area of a horizontal tank;

   3. 100 % of the first 30 feet above grade of the shell area of a vertical tank (excluding the roof area) and the bottom surface areas, if exposed.

b) Determine the initial value for the number of cubic feet per hour (CFH) of liquid vaporized (converted to free air). This may be done by use of Table 5-3.5 and the wetted area as calculated in accordance with Subsection a;

c) Modify the venting requirement as applicable. To calculate the number of cubic feet of free air to be vented, multiply the CFM from Table 5-3.5 times the following factors for which this installation qualifies. Only one factor can be used for any one tank.

1. 0.25 if drainage is capable of removing the contents of the largest tank in 10 minutes or less;

2. 0.15 if automatic water spray protection is provided for each tank, in accordance with NFPA 15, *Water Spray Fixed Systems for Fire Protection*, or automatic sprinkler protection;

3. 0.15 if tanks and associated piping have been insulated and meet all of the following performance criteria:

   - Insulation must be able to remain in place under fire exposure;

   - Insulation must be able to remain in place when subjected to hose stream impingement during fire exposure;

   - Insulation must maintain a maximum conductance value of 4.0 Btu's per hour per ft^2 per °F (Btu/hr/ ft^2/°F) when the outer insulation is at a temperature of 1660°F (904°C) and when the mean temperature of the insulation is 1,000°F (538°C).

d) Compare the CFH of free ethyl alcohol vapor calculated above and the manufacturer's catalog values to determine the proper size flame arrester, conservation vent, or combination conservation vent/flame arrester.

5-3.6 The flame arrester should be located within the limitations indicated by the manufacturer. Caution should be taken not to exceed the manufacturer's maximum recommended length of the vent pipe between the flame arrester and the open end of the vent pipe.

5-3.7 Manifolding of tank vents is not recommended unless each tank is equipped with its own flame arrester. An explosion in the vapor space of one tank might involve another tank.

5-3.8 Vents, vent pipes, screens, and flame arresters should be inspected frequently and maintained free of obstructions to prevent over pressurization of a tank during filling, emptying, or fire exposure.

5-3.9 The outlet of all vents and vent drains on tanks equipped with emergency venting should be arranged to discharge in such a way as to prevent localized overheating of or flame impingement on any part of the tank, in the event vapors from such vents are ignited.

5-3.10 Each tank venting device should have stamped on it the opening pressure, the pressure at which the valve reaches the full open position, and the flow capacity at the latter pressure. If the start to open pressure is less than 2.5 psig (17 kPa) and the pressure at full open position is greater than 2.5 psig (17 kPa), the flow capacity at 2.5 psig (17 kPa) should also be stamped on the venting device. The flow capacity should be expressed in cubic feet per hour of air at 60°F (15°C) and 14.7 psia (100 kPa). The flow capacity of tank venting devices under 8 inches (200mm) in nominal pipe size should be determined by actual test of each type and size of vent. These flow tests may be conducted by the manufacturer if certified by a qualified impartial observer, or may be conducted by a qualified, impartial outside agency. The flow capacity of tank venting devices, eight-inches nominal pipe size and larger, including manhole covers with long bolts or equivalent, may be calculated provided that the opening pressure is actually measured, the rating pressure and corresponding free orifice areas are stated, the word "calculated" appears on the name plate, and the computation is based on a flow coefficient of 0.5 applied to the rated orifice area.

A suitable formula for this calculation is:

$$CFH = 1{,}667\, C_f A \sqrt{P_t - P_a}$$

where

CFH = venting requirement in cubic feet of free air per hour

C_f = 0.5 (the flow coefficient)

A = the orifice area in square inches

P_t = the absolute pressure inside the tank in inches of water

P_a = the absolute atmospheric pressure outside the tank in inches of water

5-3.11 Tank Openings Other Than Vents

5-3.11.1 Except as modified by this guide, tank openings other than vents should meet the requirements of one of the following, as applicable

- NFPA 30, *Flammable and Combustible Liquid Code. See Tank Openings Other than Vents for Aboveground Tanks*
- NFPA 30, *Flammable and Combustible Liquid Code. See Tank Openings Other than Vents for Tanks Inside Tank Buildings*

5-3.11.2 Connections for all tank openings at or below the liquid level should be liquid-tight.

5-3.11.3 Openings above the liquid level should be normally closed, with covers weighted or bolted to prevent vapors leaking to the atmosphere.

5-3.11.4 Each connection to a tank through which liquid can normally flow should be provided with a quick shut-off internal or external valve located as close as practical to the shell of the tank. For tank valve requirements refer to Section 5-8, "Piping, Valves, and Fittings".

5-3.11.5 Openings for manual gauging of liquids, if independent of the fill pipe, should be provided with a vapor-tight cap or cover. Openings should be kept closed when not gauging. Each such opening should be protected by means of a spring-loaded check valve or other approved device that automatically closes.

5-3.11.6 The fill pipe inside the tank should be installed to avoid excessive vibration of the pipe and should be directed at the side wall to avoid splash filling.

5-3.11.7 Tanks installed in areas subject to freezing or sticking of conservation vents and/or flame arresters may have a spring loaded vacuum-breaker valve installed on a tank outlet separate from the vent line to prevent tank implosions.

5-4 TANK LOCATION

5-4.1 Installation of Outside, Aboveground Tanks

5-4.1.1 Above ground alcohol tanks should be equipped with emergency venting devices or be designed with a weak roof-to-shell seam to prevent internal pressures from exceeding tank design specifications, and should be located in accordance with Table 5-4.1.1.

5-4.1.2 Where end failure of horizontal tanks can expose property, the tanks should be placed with the longitudinal axis parallel to such property.

5-4.1.3 Spacing (shell-to-shell) between any two adjacent aboveground tanks should be greater than 1/6 the sum of the adjacent tank diameters and should not be less than 3 feet.

5-4.1.4 Tanks should be spaced so that each storage tank is accessible for fire-fighting purposes. Refer to NFPA 30, *Flammable and Combustible Liquids Code.*

5-4.2 Underground Storage Tanks. It is not standard industry practice to use underground storage tanks for ethyl alcohol. However, if underground storage tanks are used, they should be properly installed and protected. Refer to NFPA 30, *Flammable and Combustible Liquids Code.*

5-4.3 Installation of Tanks Inside Buildings

5-4.3.1 For all tanks over 2,000-gallon (7600 L) capacity, a minimum of three (3) feet spacing between tanks should be provided. Access to all vertical surfaces should be provided regardless of tank size.

5-4.3.2 Clearance between the top of the tank and the building structure should be a minimum of 3 feet.

5-4.3.3 Installation of tanks below grade is not recommended.

5-4.3.4 Tanks may be located at any above grade level, if proper drainage is provided. Refer to Section 5-6, "Spill Control".

5-5 OVERFLOW/OVERFILL PROTECTION

5-5.1 Methods or arrangements to prevent spills from an overflow or overfill situation should be considered for all tank installations and especially for interior tank installations and where the transfer is between separate buildings and/or remote areas and there is minimal supervision of the transfer process. Storage tanks, process tanks, or other equipment, to which flammable liquids are transferred or stored, should be equipped with a device, interlocks, or other means to prevent accidental spills. In addition to operational procedures, methods to identify or stop spills could include 1) trapped overflow drain back to supply source or other point of safe discharge, 2) level and high level detectors or switches arranged to sound an alarm, close valves, and/or stop pumps. All equipment, interlocks, alarms, switches and associated wiring should be listed for use in accordance with the classification of the area in which they are installed. Refer to NFPA 70, *National Electric Code* and Chapter 6.

5-5.2 In areas where an undetected spill may occur, a vapor detection system may be another option to consider. The system should be arranged to activate when the vapor concentration exceeds 25% of the LFL. Activation should result in the automatic operation of emergency exhaust air systems in the area and/or the shutoff of electrics or processes in the area, or both. The vapor detector system, interlocks, and all associated wiring should be listed for use in accordance with the classification of the area in which they are installed. Refer to NFPA 70, *National Electric Code* and Chapter 6.

5-6 SPILL CONTROL

5-6.1 General. Provisions should be made to prevent accidental spills from endangering either important facilities or adjoining property. For exterior tanks, this can be done by remote impounding, or diking and impounding. For interior areas, curbing and drainage should be provided.

5-6.2 Exterior Tanks – Remote Impounding. When protection of either adjoining property or important property is by means of drainage away from alcohol tanks, the system should comply with the following:

a) A slope of not less than one percent (1%) away from the tank for at least 50 feet (15 m) in the direction of the impounding area;

b) The impounding area should have capacity not less than 200% of the largest tank than can drain into it;

c) The route of the drainage system should be located so that neither other tanks nor adjoining property will be seriously exposed should the alcohol be ignited;

d) The impounding area should be located no closer than 50 feet (15 m) from any property line that is or can be built upon, or from any tank.

5-6.3 Exterior Tanks - Impounding with Diking. When protection is by means of impounding around the tanks by diking, such a system should comply with the following:

a) A slope of not less than one percent (1%) away from the tank should be provided for at least 50 feet (15 m) or to the dike base, whichever is less.

b) The capacity of the diked area should not be less than 110% of the capacity of the largest tank within the diked area. To allow for volume occupied by tanks, the capacity of the diked area enclosing more than one tank should be calculated after deducting the volume of the tanks, other than the largest tank, below the height of the dike.

c) To permit access, the outside base of the dike at ground level should be no closer than 10 feet (3 m) to any property line that is or can be built upon.

d) Walls of the diked area should be of earth, steel, concrete, or solid masonry designed to be liquid-tight and to withstand a full hydrostatic head. Earthen walls 3 feet (1 m), or more in height should have a flat section at the top not less than 2 feet (0.6 m) wide. The slope of an earthen wall should be consistent with the angle of repose of the material of which the wall is constructed.

e) Except as provided in (f), the walls of the diked area should be restricted to an average interior height of 6 feet (1.8 m) above interior grade.

f) Dikes may be higher than an average of 6 feet (1.8 m) above interior grade where provisions are made for normal access and necessary emergency access to tanks, valves, and other equipment and safe egress from the diked enclosure:

   1) Where the average height of the dike is over 12 feet (3.6 m) high, measured from interior grade, or where the distance between any tank and the top inside edge of the dike wall is less than the height of the dike wall, provisions should be made for normal operation of valves and for access to tank roof(s) without entering below the top of the dike. These provisions may be met through the use of remote operated valves, elevated walkways, or similar arrangements.

   2) Piping passing through dike walls should be designed to prevent excessive stresses as a result of settlement or fire exposure.

   3) The minimum distance between tanks and the base of the interior dike walls should be 5 feet (1.5 m).

g) Each diked area containing two or more tanks should be subdivided preferably by drainage channels or at least by intermediate curbs in order to prevent small spills from endangering adjacent tanks within the diked area.

h) Storage of combustible materials and empty or full drums or barrels should not be permitted within the diked area.

i) Where provision is made for draining water from diked areas, such drains shall be controllable to prevent spills from entering natural water courses, public sewers, or public drains. Control of drainage shall be accessible under fire conditions from outside the dike.

5-6.4 Interior Areas - Drainage and/or Containment Systems

5-6.4.1 Drainage or containment systems should be provided by means of curbs, scuppers, special drains, or other suitable means to prevent the flow of spills throughout the building. The systems shall have sufficient capacity to carry off expected discharge of water from fire protection systems and hose streams.

5-6.4.2 In large tank rooms it is desirable to provide intermediate curbs or trench drains to improve separation and spill control.

5-7 VENTILATION

5-7.1 Enclosed areas handling or using alcohol should be ventilated at a rate sufficient to maintain the concentration of vapors within the area at or below 25% of the LFL. This should be confirmed by sampling of the actual vapor concentration under normal operating conditions.

5-7.2 The sampling should be conducted at a 5 ft (1.5 m) radius from each potential vapor source extending to or toward the bottom and the top of the enclosed processing area. The vapor concentration used to determine the required ventilation rate should be the highest measured concentration during the sampling procedure.

5-7.3 An acceptable alternative is to provide ventilation at a rate of not less than 1 cfm/ft^2 (0.3 m^3/min) of solid floor area. Ventilation should be accomplished by natural or mechanical means, with discharge or exhaust to a safe location, without recirculation of the exhaust air.

EXCEPTION: Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over 25% of the LFL are detected.

5-7.4 Provision should be made for introduction of make-up air in such a manner as to avoid short-circuiting of the ventilation. Ventilation should be arranged to include all floors areas or pits where flammable vapors may collect. Where natural ventilation is inadequate, mechanical ventilation should be provided and should be kept in operation while alcohol is being handled. Local or spot ventilation may be needed for the control of special fire or health hazards. Such ventilation, if provided, can be utilized for up to 75% of the required ventilation. Refer to NFPA 91, *Exhaust Systems for Air Conveying of*

Vapors, Gases, Mists, and Noncombustible Particulate Solids, and NFPA 90A, *Installation of Air Conditioning and Ventilating Systems*.

5-8 PIPING, VALVES, AND FITTINGS

5-8.1 General

5-8.1.1 Piping systems consist of pipe, tubing, flanges, bolts, gaskets, valves, and fittings, the pressure-containing parts of other components, such as expansion joints and strainers, and devices that serve such purposes as mixing, separating, distributing, metering, or controlling flow.

5-8.1.2 The design, fabrication, assembly, test, and inspection of piping systems containing alcohol should be suitable for the expected working pressures and structural stresses, and should conform to applicable sections of ASME B31, *Code for Pressure Piping*.

5-8.2 Materials

5-8.2.1 Pipes, valves, fittings, and other pressure-containing parts should meet the material specifications and pressure and temperature limitations of the applicable sections of the ASME B31, *Code for Pressure Piping*.

5-8.2.2 Pipe, valves, and other pressure-containing parts should be of steel, cast iron, brass, copper, aluminum, or malleable iron.

5-8.2.3 The use of plastic or similar materials for fixed pipe systems, valves, and other pressure-containing parts for alcohol liquids is not recommended.

5-8.2.4 For transfer operations, fixed piping is recommended. Where fixed piping is not practical, reinforced flexible hoses which meet the following criteria are preferred:

a) Pressure-tested to at least two times its normal operating pressure;

b) Provide ample electrical bonding capability between its two transfer points;

c) Capable of withstanding the mechanical abuse to which it may be subjected.

5-8.2.5 Piping, valves, and fittings may have combustible or noncombustible seats or linings or both.

5-8.3 Pipe Joints

5-8.3.1 Joints should be liquid-tight. Welded, screwed or flanged joints or approved connectors should be used. Threaded joints and connections should be made tight with a suitable lubricant or piping compound.

5-8.3.2 Joints of piping systems handling alcohol located in concealed spaces within buildings or structures or above suspended ceiling systems should be welded.

5-8.3.3 The use of friction/pressure devices at pipe joints for the mechanical continuity of the piping is not recommended.

5-8.3.4 Piping systems should be supported and protected against physical damage and excessive stresses arising from earthquake, settlement, vibration, expansion, or contraction.

5-8.4 Protection Against Corrosion. All piping for alcohol, where subject to external corrosion, should be painted or otherwise protected.

5-8.5 Valves. Piping systems should contain a sufficient number of valves to operate the system properly and safely. Piping systems in connection with pumps should contain a sufficient number of valves to properly control the flow of liquid in normal operation and in the event of physical damage. Each connection to pipe lines, by which equipment such as tank cars or tank vehicles discharge liquids by means of pumps into storage tanks, should be provided with a check valve for automatic protection against backflow if the piping arrangement is such that backflow from the system is possible.

5-8.6 Testing. Unless tested in accordance with the applicable sections of ASME B31, *Code for Pressure Piping*, all piping before being covered, enclosed, or placed in use should be hydrostatically tested to 150% of the maximum anticipated pressure of the system, but not less than 5 psig (35 kPA) at the highest point of the system. This test should be maintained for a sufficient time to complete a visual inspection of all joints and connections, or for at least 10 minutes, whichever is greater.

5-8.7 Identification. Piping systems containing alcohol or alcohol vapor should be clearly identified as to content.

5-9 LOADING AND UNLOADING FACILITIES

5-9.1 Physical Layout

5-9.1.1 Facilities for tank truck and tank rail car loading or unloading should be separated from above ground tanks, warehouses, other plant buildings, or the nearest line of adjoining property that can be built on. A distance of at least 25 feet (8 m) measured from the nearest position of any fill spout, unless blank building walls or exposure protection should be provided. Buildings for pumps or shelters for personnel may be a part of the facility.

5-9.1.2 The loading/unloading site should be arranged to provide natural drainage of escaping flammable liquids or diking and drains as needed to channel flow to a safe location.

5-9.2 Loading. A tank vehicle should be top loaded. Valves used for the final control of flow should be of the self-closing type. These must be manually held open unless automatic means are provided for shutting off the flow when the tank vehicle is full or after filling of a preset amount.

5-9.3 Static Protection. Loading and unloading facilities should be designed and constructed to prevent stray currents or potential differences between vehicles and the fixed piping systems during operations. The method to prevent this buildup is to bond together all conductive objects in the facilities and then provide an electrical path to drain all field potentials before electrical discharges occur.

5-9.3.1 Protection consists of electrically connecting all piping, motors, pumps and rack structures within the facility with a separate non-current carrying conductor connected to a suitable ground system. The ground system should be terminated at a water pipe connection (not sprinkler piping) or suitable ground rods driven into the earth. Each rail tank car or tank truck should be connected to the ground system through a flexible wire lead with an approved ground clamp device. The connection should be made to the designated vehicle grounding pad. Refer to Figures 5-9.3.1a and 5-9.3.1b. At rail facilities the tracks should be electrically isolated from the main tracks and connected to the facility ground system.

5-9.3.2 Rail tank cars or tank truck grounding connectors should be attached to the ground system prior to opening any covers or valves on the vehicle and should remain attached until filling operations are complete and all covers and valves have been closed and secured.

5-9.3.3 Filling of high proof alcohol through top openings into rail tank cars or tank trucks should be by means of a downspout. To reduce splashing, the downspout should extend within 6 in (150 mm) of the bottom of the tank or flow should be directed against the side of the tank. Note: If a downspout to the bottom of the tank is used, a vacuum breaker should be provided to prevent siphoning

5-9.3.4 All electric equipment within the loading and unloading facility should be properly designed and installed. Refer to Chapter 6.

5-10 PROTECTION

5-10.1 Automatic sprinkler protection should be provided in all areas handling alcohol. For bulk loading and unloading stations, deluge type systems should be considered. Refer to Chapter 4.

5-10.2 Vapor detection systems may be considered for tank rooms and other areas which are unoccupied during normal operations and/or transfers. Refer to Section 5-5, "Overflow/Overfill Protection".

5-10.3 A water supply with appropriate hose should be provided within tank rooms and other areas to permit wash-down and dilution of alcohol spills. Domestic systems are acceptable.

Table 5-3.3
Required Thermal Venting Capacity
(Expressed in Cubic Feet per Hour of Air)
Interpolation Permitted

Tank Capacity gallons (liters)		Vacuum All Stocks	Pressure	
			Closed Cup Flash Point Below 100°F (<38°C)	Closed Cup Flash Point Above 100°F (>38°C)
2,500	(9,464)	75	75	---
5,000	(18,927)	125	125	60
10,000	(37,854)	250	250	137
15,000	(56,781)	350	350	200
20,000	(75,708)	480	480	270
25,000	(94,635)	600	600	350
30,000	(113,562)	730	730	425
35,000	(132,489)	850	850	500
42,000	(158,987)	1,000	1,000	600
84,000	(317,975)	2,000	2,000	1,200
126,000	(476,962)	3,000	3,000	1,800
168,000	(635,949)	4,000	4,000	2,400
210,000	(794,936)	5,000	5,000	3,000
420,000	(1,589,873)	10,000	10,000	6,000
630,000	(2,384,809)	15,000	15,000	9,000
840,000	(3,179,746)	20,000	20,000	12,000
1,050,000	(3,974,682)	24,000	24,000	15,000
1,260,000	(4,769,619)	28,000	28,000	17,000
1,470,000	(5,564,555)	31,000	31,000	19,000
1,680,000	(6,359,492)	34,000	34,000	21,000
1,890,000	(7,154,428)	37,000	37,000	23,000
2,100,000	(7,949,365)	40,000	40,000	24,000
2,520,000	(9,539,238)	44,000	44,000	27,000
2,940,000	(11,129,111)	48,000	48,000	29,000
3,360,000	(12,718,984)	52,000	52,000	31,000
3,780,000	(14,308,857)	56,000	56,000	34,000
4,200,000	(15,898,729)	60,000	60,000	36,000
5,049,000	(19,112,544)	68,000	68,000	41,000
5,880,000	(22,258,221)	75,000	75,000	45,000
6,720,000	(25,437,967)	82,000	82,000	50,000
7,560,000	(28,617,713)	90,000	90,000	54,000

Table 5-3.5
Tank Wetted Area versus Cubic Feet per Hour for Free Ethyl Alcohol Vapor

	(14.7 psia and 60°F)		**(101.3 KPa and 15.6°C)**		
sq ft	**CFH**	**sq ft**	**CFH**	**sq ft**	**CFH**
20	11,300	200	112,900	1,000	280,400
30	17,000	250	127,900	1,200	298,000
40	22,600	300	141,800	1,400	314,100
50	28,200	350	154,100	1,600	328,500
60	33,900	400	167,000	1,800	341,900
70	39,500	500	189,400	2,000	354,200
80	45,100	600	209,800	2,400	376,700
90	50,800	700	229,000	2,800	397,000
100	56,200	800	247,200	and over	
120	67,500	900	263,800		
140	78,700	1,000	280,440		
160	89,900				
180	101,700				
200	112,900				

NOTE: Unit Conversions – 1 sq ft = 0.0929 sq m; 1 cu ft = 0.02832 cu m
Interpolate for intermediate values.

Table 5-4.1.1
Outside Above Ground Tank Locations

Protection	Capacity of Tank gallon (liters)		Minimum Distance from Property Lines That Is or Can Be Built Upon, Including Opposite Side of a Public Way, or from the Nearest Important Building on the Same Property. ft (m)	
Exposure Protection Provided*	12,000	(45,420) or less	15	(4.57)
	30,000	(113,500) or less	20	(6.10)
	50,000	(189,250) or less	30	(9.14)
	100,000	(378,500) or less	50	(15.24)
	500,000	(1,892,500) or less	80	(24.38)
	1,000,000	(3,785,000) or less	100	(30.48)
	2,000,000	(7,570,000) or less	135	(41.15)
	3,000,000	(11,355,000) or less	165	(50.29)
	over 3,000,000	(11,355,000)	175	(53.34)
Approved Water Spray and Adequate Drainage			½ above distances	
None			2 times above distances	

* Exposure protection can be defined as fire protection for structures on the adjacent properties. Acceptable fire protection would be response by a public fire department or by a fully trained plant fire brigade having the capability of providing cooling water streams on the adjacent structures.

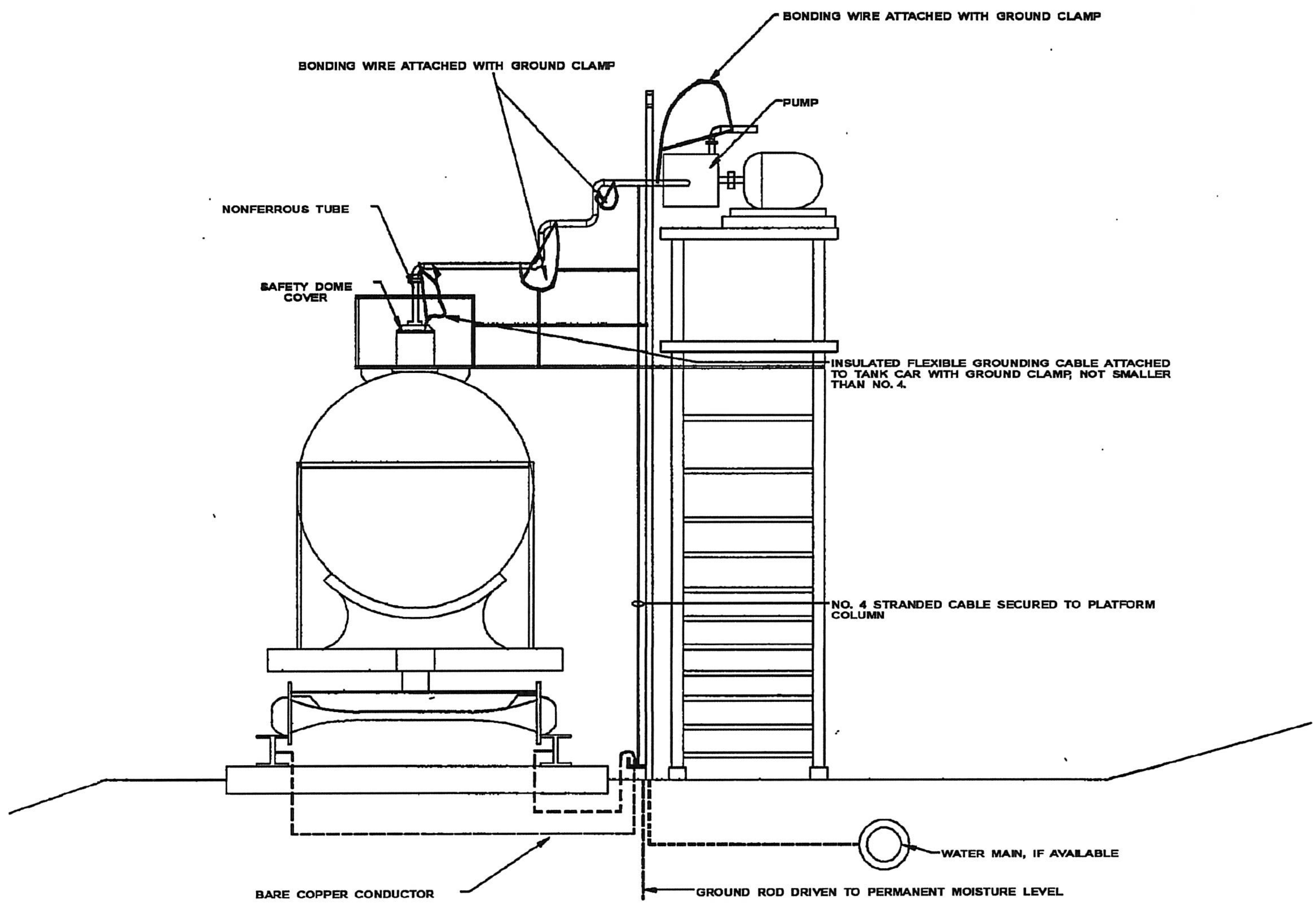


Figure 5-9.3.1a Grounding Connections for Tank Car Stations

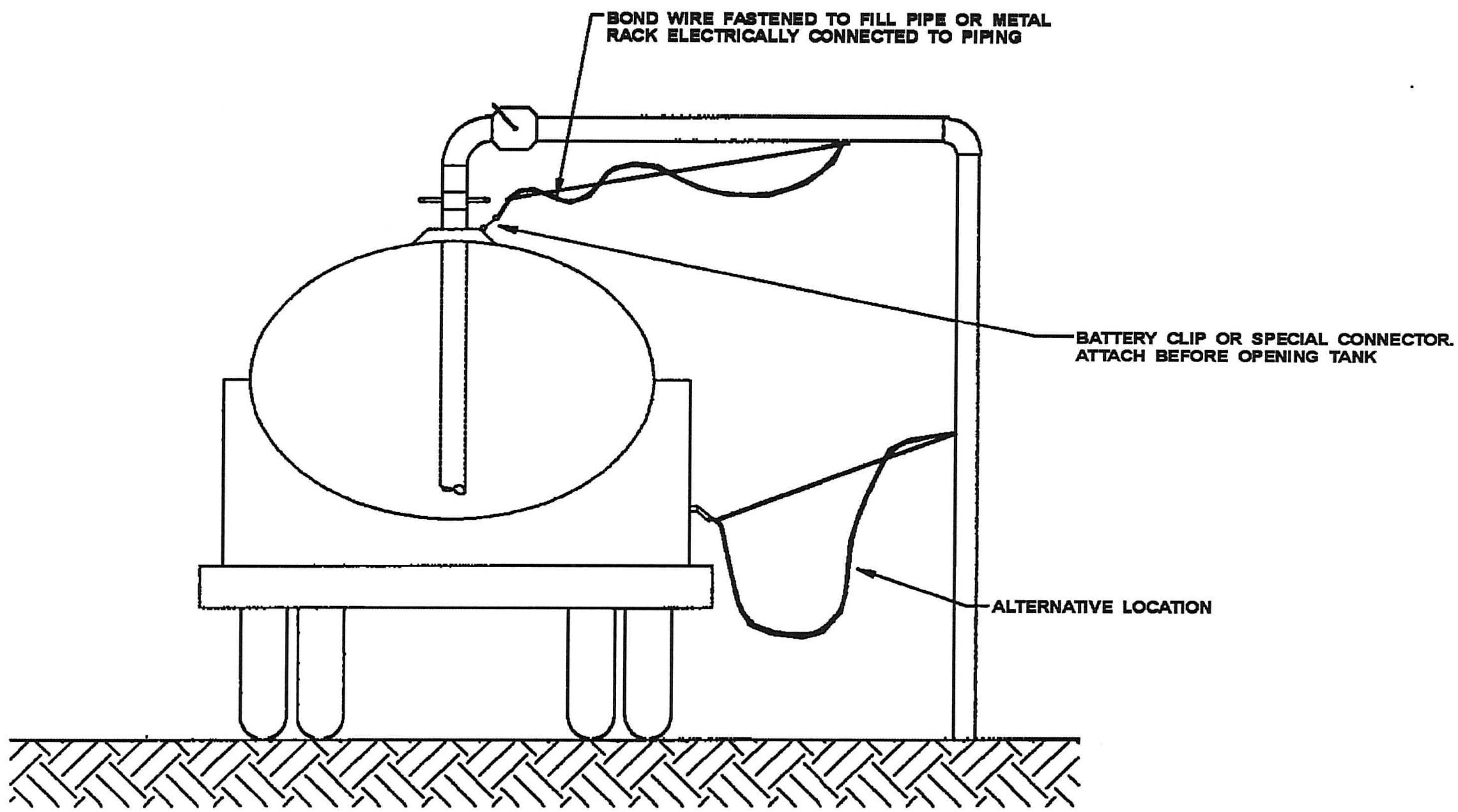


Figure 5-9.3.1b Grounding Connections for Tank Truck Stations

Chapter 6
Electrics

6-1 GENERAL

6-1.1 The areas to which this chapter applies are those in which explosive dusts and flammable vapors and liquids are:

a) processed;

b) stored; and

c) loaded, unloaded, or otherwise handled in beverage alcohol production facilities and, as such, require individual design consideration.

6-1.2 Alcohol processing facilities consist of specialized equipment within which liquids or vapors may be continuously processed in large quantities, sometimes at elevated temperatures and pressures. Both chemical and physical changes occur in these materials, and during "abnormal" conditions the composition and properties may change drastically. These conditions together with considerations of operating continuity, dictate standards of design that are not warranted in other industries.

6-1.3 Selecting the proper types of electrical equipment for hazardous locations requires considerable judgment. Potential hazard severity must be correctly evaluated to assume safety and to avoid unnecessarily expensive installations. Electrical equipment specially suited for the location should be used to make the installation safe. For example, in locations where hazardous concentrations of flammable vapors normally exist, equipment rated for Class I, Division I, or Zone 1 areas is recommended. Refer to Section 6-2, "Area Classification".

6-1.4 Where possible, electrical equipment and wiring is best located outside hazardous locations. For example, lights may be located outside a room, illuminating the inside through transparent panels, thereby eliminating the ignition source. Motors may be located outside hazardous locations with properly sealed shafts extending into the hazardous location to drive mechanical equipment. Power equipment and control instruments may be located in remote, nonhazardous locations or in pressurized rooms that are suitable for general purpose equipment.

6-1.5 The *National Electrical Code* (NEC), also known as NFPA 70, has established criteria for electrically classifying specific locations.

6-1.6 The critical step in electrical classification is to determine the existence, degree, and extent of the classified areas. To do this, the presence of ignitable dust or vapor under normal, as well as abnormal operating conditions, such as equipment breakdowns, must be determined. Also, the total area that either is or potentially can be affected under both normal and abnormal conditions, must be considered. The quantity of the substance that is or may be liberated, its physical characteristics, and the natural tendency of the substance to disperse in the atmosphere must be recognized.

6-2 AREA CLASSIFICATION

6-2.1 Electrical installations and equipment are potential ignition sources. Therefore electrical equipment in these following areas must be specified as to Classification, Group, and Division/Zone as shown in Table 6-2.1 and Figures 6-2.1a to 6-2.1n., For further information concerning area classifications, refer to Appendix D or Article 500 and Article 505 of NFPA 70, *National Electrical Code*, NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Area.*

Note: An installation may be designed using either the classification scheme of Article 500 (Division) or the classification scheme of Article 505 (Zone). Both schemes cannot be used for classifying the same area. In areas within the same facility, Class I, Zone 2 locations are allowed to be adjacent to and share the same border, but not overlap Class I, Division 2 locations. However, Class I, Zone 0 or Zone 1 locations are not allowed to be adjacent to and share the same border with Class I, Division I or Division 2 locations.

6-2.2 All electrical equipment and wiring should be of a type specified by and should be installed in accordance with NFPA 70, *National Electrical Code.*

6-2.3 In the application of classified areas, a classified area need not extend beyond an unpierced floor, wall, roof, or other vapor-tight partition.

6-2.4 Equipment approved for use in a Zone 0 location is permissible in a Zone 1 location. Equipment approved for use in a Zone 0 or Zone 1 location is permissible in a Zone 2 location. Equipment approved for a Division 1 location is permissible for use in a Division 2 area. The use of equipment approved for use in a Division 2 location is not considered acceptable in a Zone 1 or Division 1 location. Equipment approved for use in Division 1 or Zone 0 hazardous location is needed within tank interiors. In some instances, there is no equipment currently available that is specifically listed for use in Zone 2 or Division 2 location. In these instances, equipment not specifically marked for use in Zone 2 or Division 2 locations may be permitted either by code or by the authority having jurisdiction. Refer to NFPA 70, *National Electrical Code*,. Equipment approved for a Class I location is not necessarily approved for a Class II location.

6-3 STATIC ELECTRICITY

6-3.1 All piping and tanks used for the storage or processing of flammable liquids should be properly bonded and grounded in accordance with NFPA 77, *Static Electricity.*

6-4 LIGHTNING PROTECTION

6-4.1 Structures containing hazardous locations should be protected from lightning. Refer to Table 6-2.1. The lightning protection equipment should be installed in accordance with NFPA 780, *Lightning Protection Code* and NFPA 70, *National Electric Code*

6-5 ELECTRONIC EQUIPMENT

6-5.1 Electronic equipment, fixed or portable, should be approved for use in areas as classified in Table 6-2.1.

6-5.2 Ordinary electrical equipment subject to alcohol vapors or grain dust can be used if enclosed and "purged". NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment* should be used as a guide in developing specific criteria.

Table 6-2.1
Area Classification

Building or Process	Class	Group	Division or Zone	Reference Figure	Explanation
Grain Handling	II	G	1		Equipment approved for use in Division 1or Zone 1 hazardous location is needed in all areas where grain dust can form a potentially explosive cloud, except those rooms or enclosures that have been specially purged, pressurized, or in some method separated from the dust hazard.
Milling	II	G	1		As above.
Dried Grain	II	G	2		Dried grain is combustible, and the dust could be explosive although the potential for this hazard is not considered nearly as serious as it is in the handling of cereal grain.
Mashing and Fermenting	Generally unclassified				At this stage of production, the ethyl alcohol content is not high enough to constitute a flammable liquid. Therefore, this area may be an unclassified electrical area. However, if it is open to an area of higher ethyl alcohol content where the product is flammable liquid, such as in the still house, all or part of the area may be classified. Refer to Section 3-3.6, "Mashing and Fermenting"
Still House	I	D	1		The operation and equipment in this area are closed systems; because the high temperatures that the alcohol is heated to and the fear that a break could cause a vapor cloud, the entire still area is classified as Division 1 or Zone 1. Exceptions may be made for pressurized or purged rooms if special care is taken to ensure that these rooms will remain so under all conditions, i.e., power failure.
Tanker Loading/ Unloading	I	D	0, 1 and 2 (see reference figures)	6-2.1c and 6-2.1d	Equipment approved for use in Division 1 or Zone 1 hazardous locations is needed in all areas where vapors may exist during loading/unloading operations or where a spill potential exists, either from over-fill or from rupture of flexible hoses. Distance requirements must be measured from the most remote anticipated loading/unloading point. It must be recognized that loading/unloading will not always take place at the same exact position. Equipment approved for use in Division 1 or Zone 0 hazardous locations is needed within tank interiors.
Tanks, Equipment and Associated Piping Areas	I	D	0, 1 and 2 (see reference figures)	6-2.1e 6-2.1f 6-2.1m and 6-2.1n	If a closed system vents outside the building, equipment approved for use in Class I, Division 2 or Zone2 hazardous locations is satisfactory for use in the surrounding area. If the system is not closed or vents inside the building, e.g., exposed filters, open tanks, Division 1 or Zone 1 equipment should be used in these areas. If tanks have hatches that may be opened in normal operations or that are not vapor-tight, equipment approved for use in Division 1 or Zone 1 hazardous locations should be used within the distances specified in Figure 6-2.1e. Any tank appurtenances that may be open during operations or used frequently such as washout lines, sample valves, etc., should also have a distance requirement for Division 1or Zone 1 equipment. Equipment approved for use in Division 1 or Zone 0 hazardous locations is needed within tank interiors.
Leakage Sources	I	D	2	6-2.1a and 6-2.1b	The area around equipment from which alcohol vapors leak during abnormal occurrences. Included are closed filters, presses, heat exchangers, blenders, mixers, etc.
Barrel Fill and Drain	I	D	1	6-2.1g 6-2.1h 6-2.1i and 6-2.1j	In areas where alcohol is exposed to the atmosphere, such as barrel drain and fill, equipment approved for use in Division 1 or Zone 1 hazardous locations should be used.

Table 6-2.1
Area Classification

Building or Process	Class	Group	Division or Zone	Reference Figure	Explanation
Barrel Warehouse	In barrel warehouses, either racked or palletized, electrical equipment approved for use in Class I, Division 2 or Zone2 hazardous locations should be used throughout. **Exception:** Ordinary electrics, such as lighting fixtures, may be used when: a) attached to the underside of the roof b) mounted beneath liquid tight floors while maintaining a minimum 5' clearance from the barrels.				Electrical equipment approved for use in Class I, Division 2 or Zone 2 hazardous locations is normally used in these areas as flammable liquid vapors are generally considerably below the lower flammable limit. **Note:** Electrical equipment for racking (ricking) machines or in sump areas should be Class I, Division 1_or Zone 1.
Bottling	I	D	1 and 2 (see reference figures)	6-2.1k and 6-2.1l	Where alcohol is open to the atmosphere under normal conditions, such as filler, and filters, a Division 1 or Zone 1 area exists. Beyond that area to the capper, a Division 2 or Zone 2 area may exist.
Finished Goods Storage	Generally unclassified				This is an unclassified area as under normal conditions flammable liquids are completely contained. Containers in these areas are less than one gallon in size with higher flash point liquids (lower alcohol content) than flammable liquid storage in other areas of the facility.

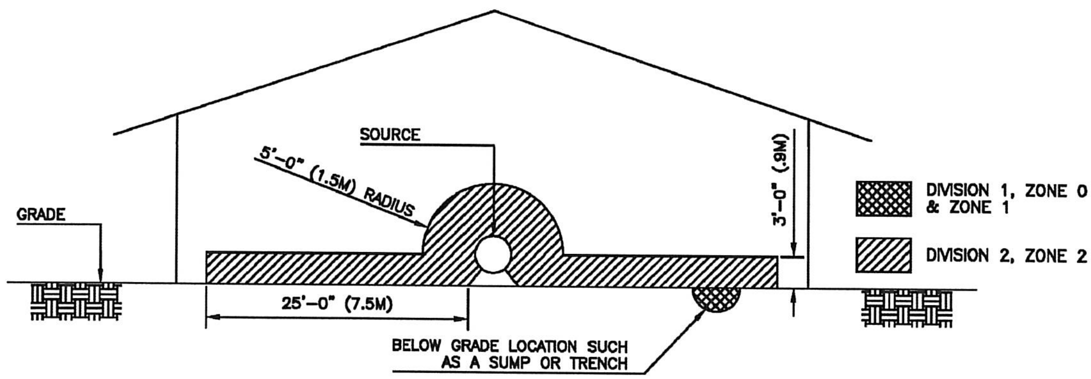


Figure 6-2.1a Leakage Source Located Indoors, at Floor Level. Adequate Ventilation is Provided

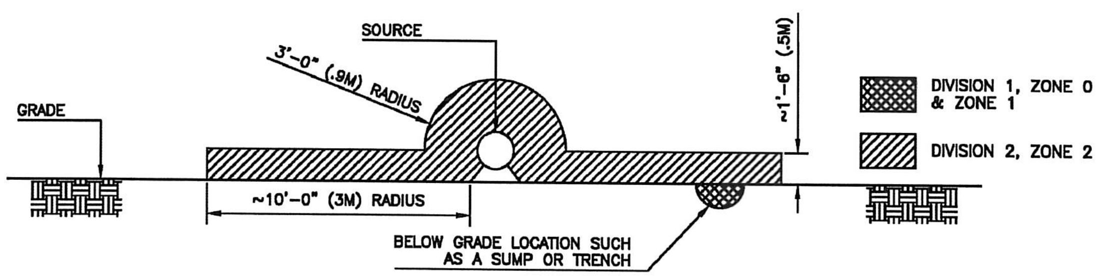
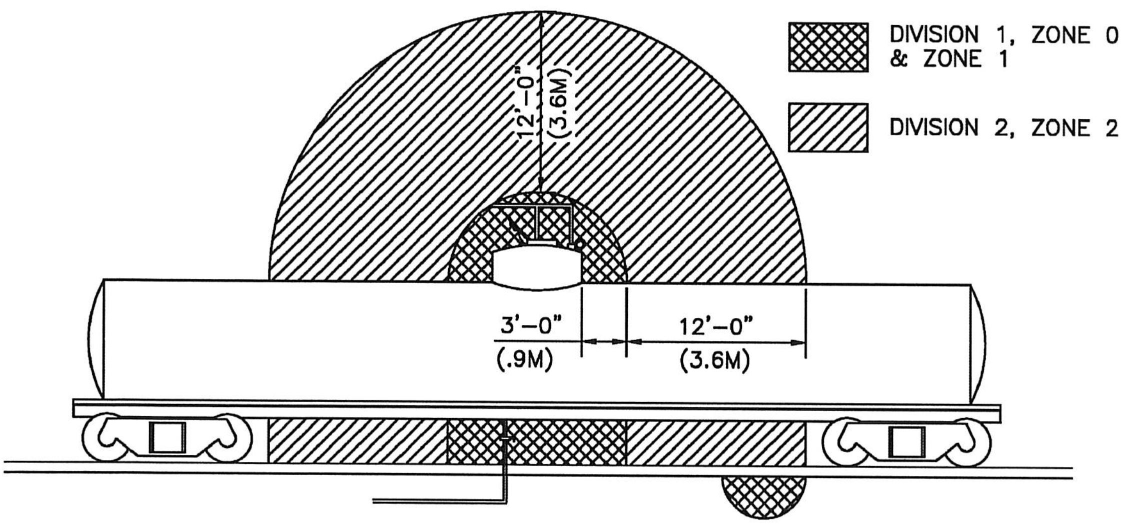


Figure 6-2.1b Leakage Source Located Outdoors, at Grade



Notes:

DIVISION 1, Zone 0 & Zone 1 within 3 ft. (.9M) of edge of dome extending in all directions to grade.
DIVISION 2, Zone 2 area between 3 ft. (.9M) and 15 ft. (4.5M) from edge of dome, extending in all directions to grade.

For tank truck measure side distance from end of tank under most advance spotting possibilities (for multiple filling & emptying locations).

Figure 6-2.1c Tank Truck and Rail Car Operations – Side View

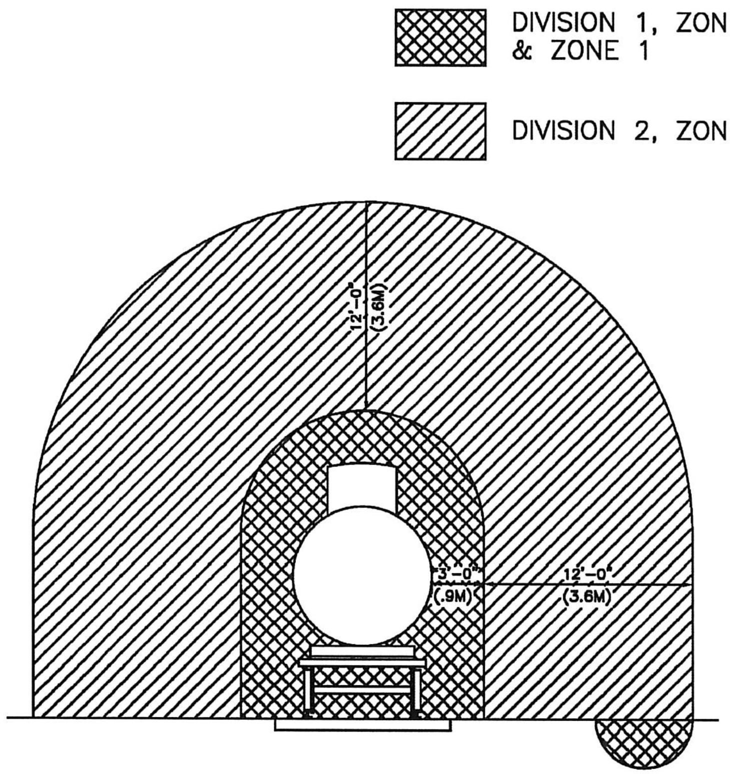


Figure 6-2.1d Tank Truck and Rail Car Operations – End View

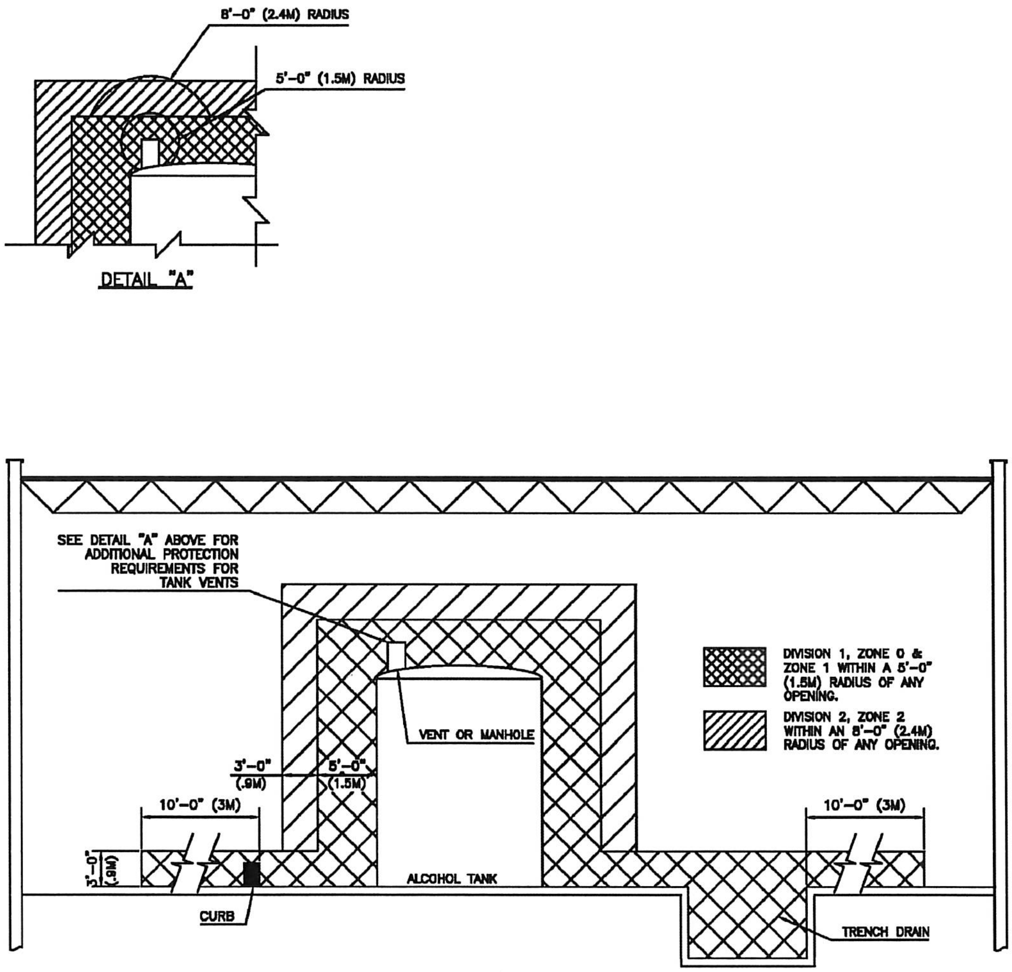


Figure 6-2.1e Tank Rooms

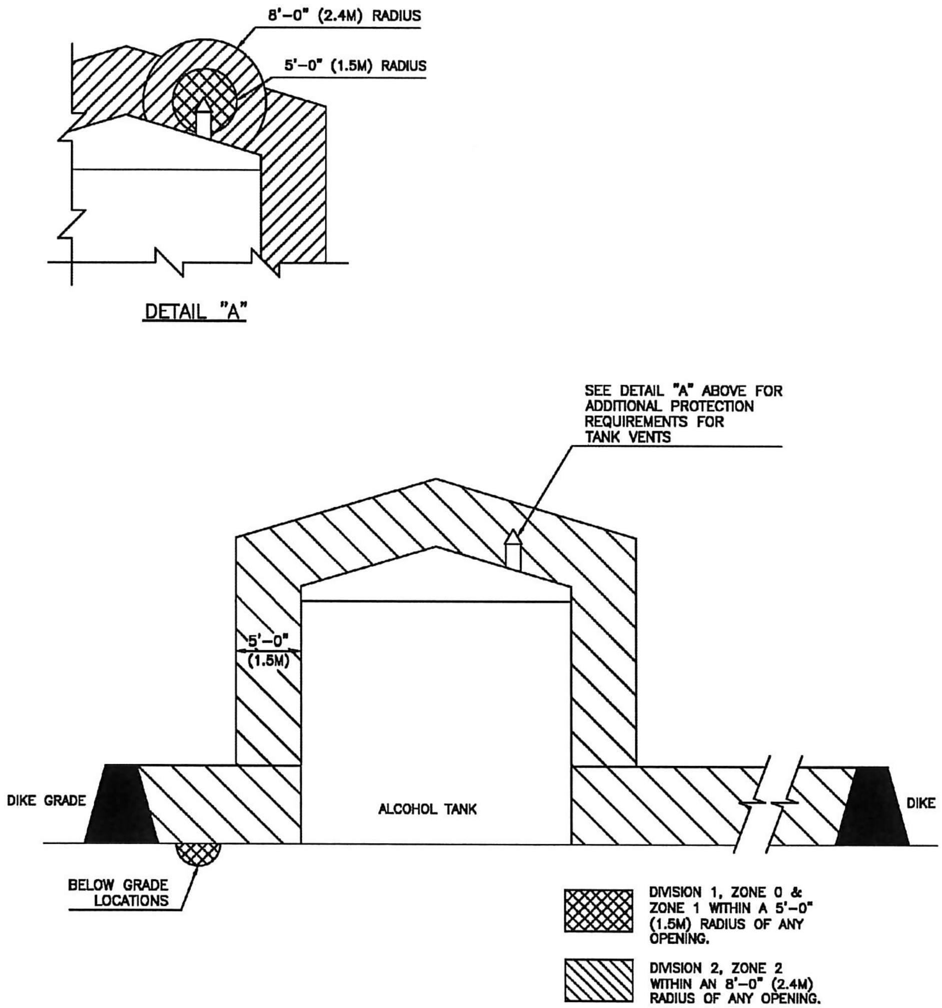


Figure 6-2.1f Outside Storage Tanks

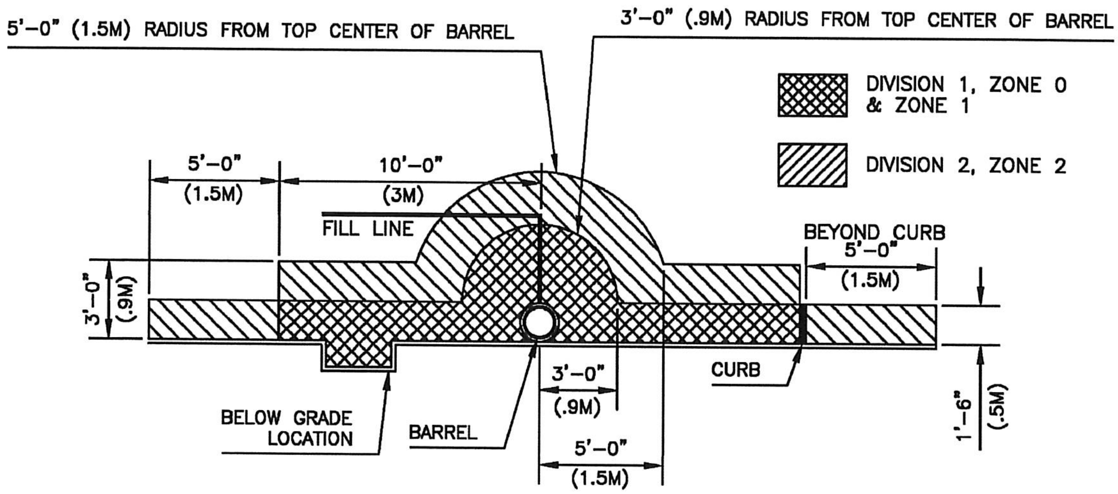


Figure 6-2.1g Barrel Fill or Drain

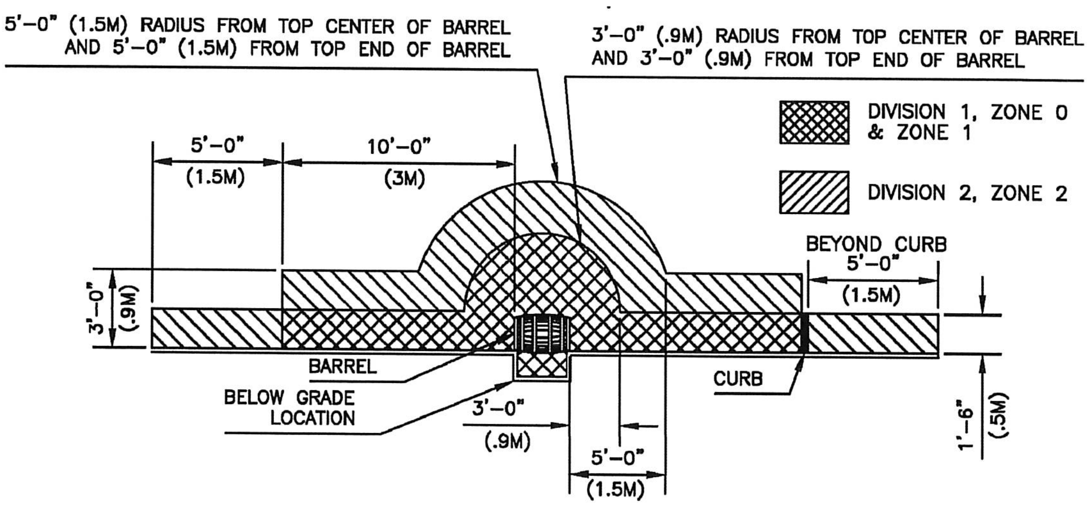


Figure 6-2.1h Barrel Dump

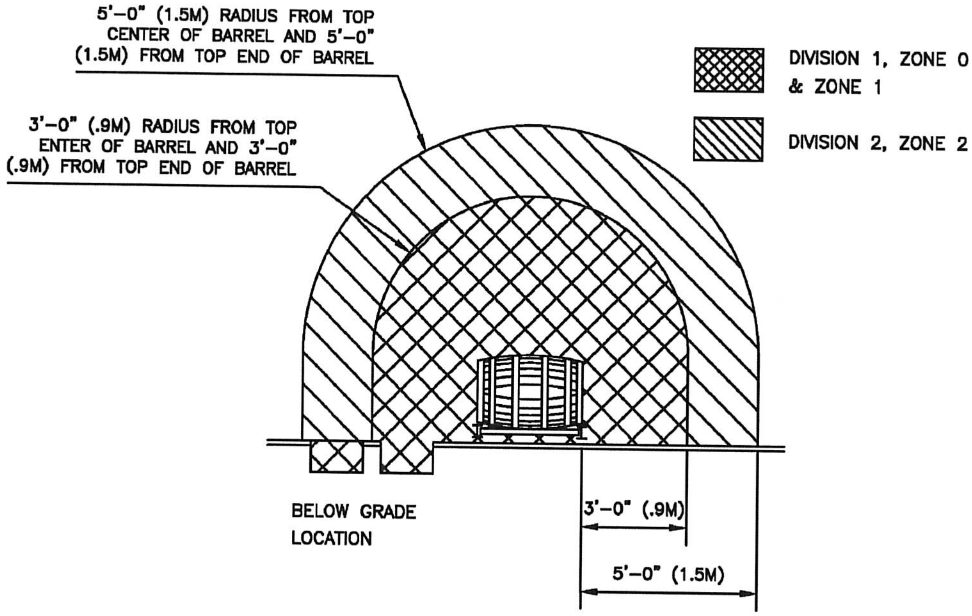


Figure 6-2.1i Barrel Conveyor

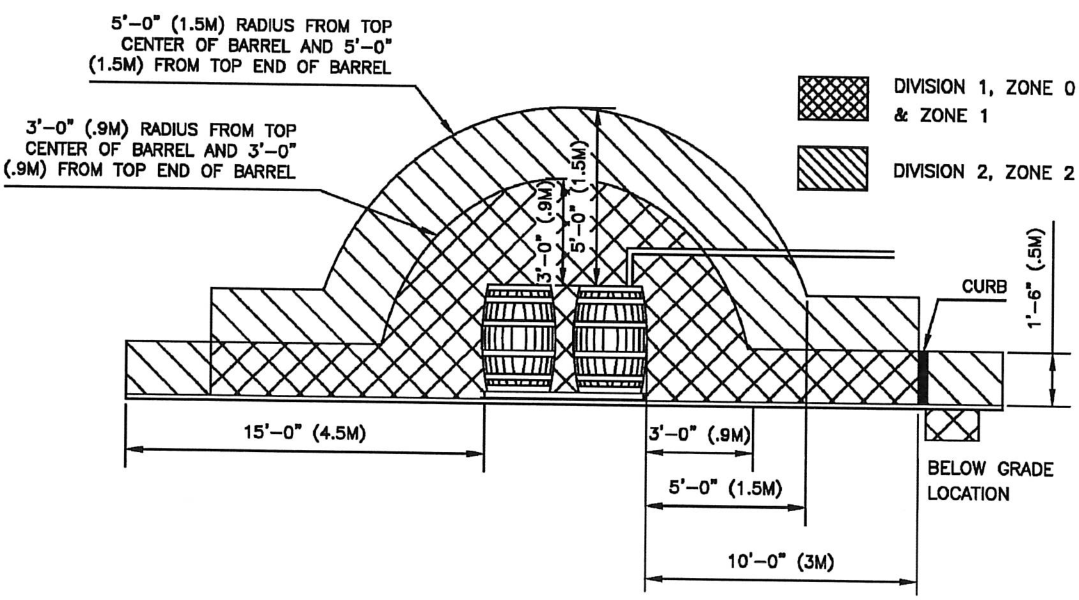


Figure 6-2.1j Barrel Drain and Fill – Barrels in Vertical Position

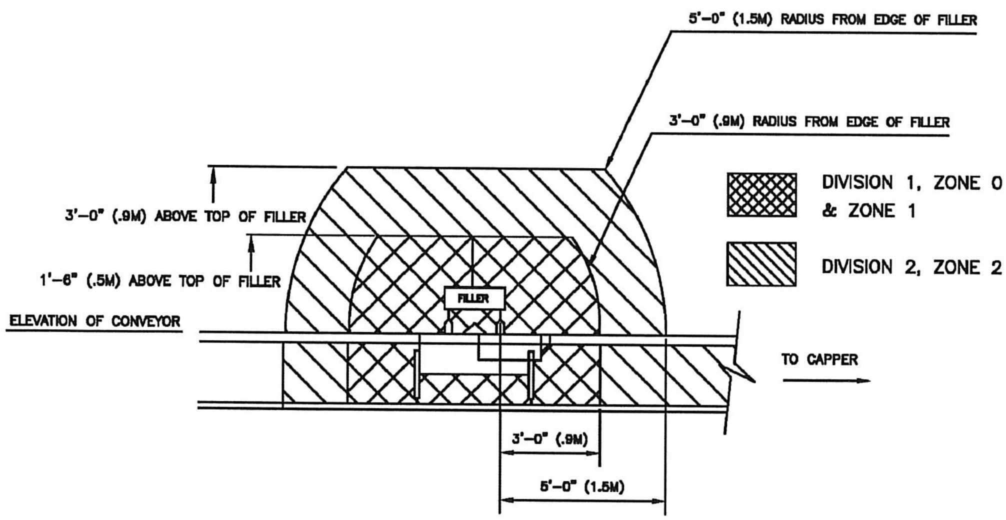


Figure 6-2.1k Bottling Filler

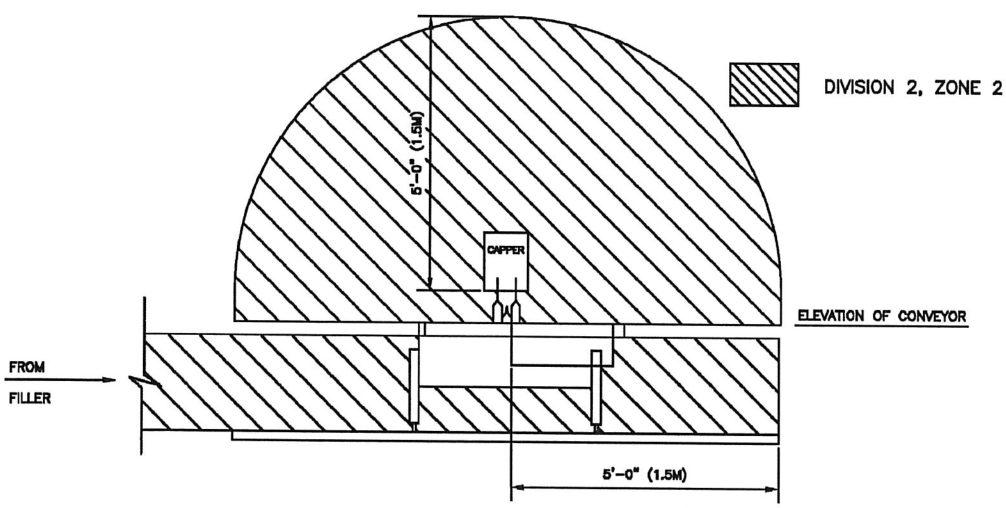


Figure 6-2.1l Bottling Capper

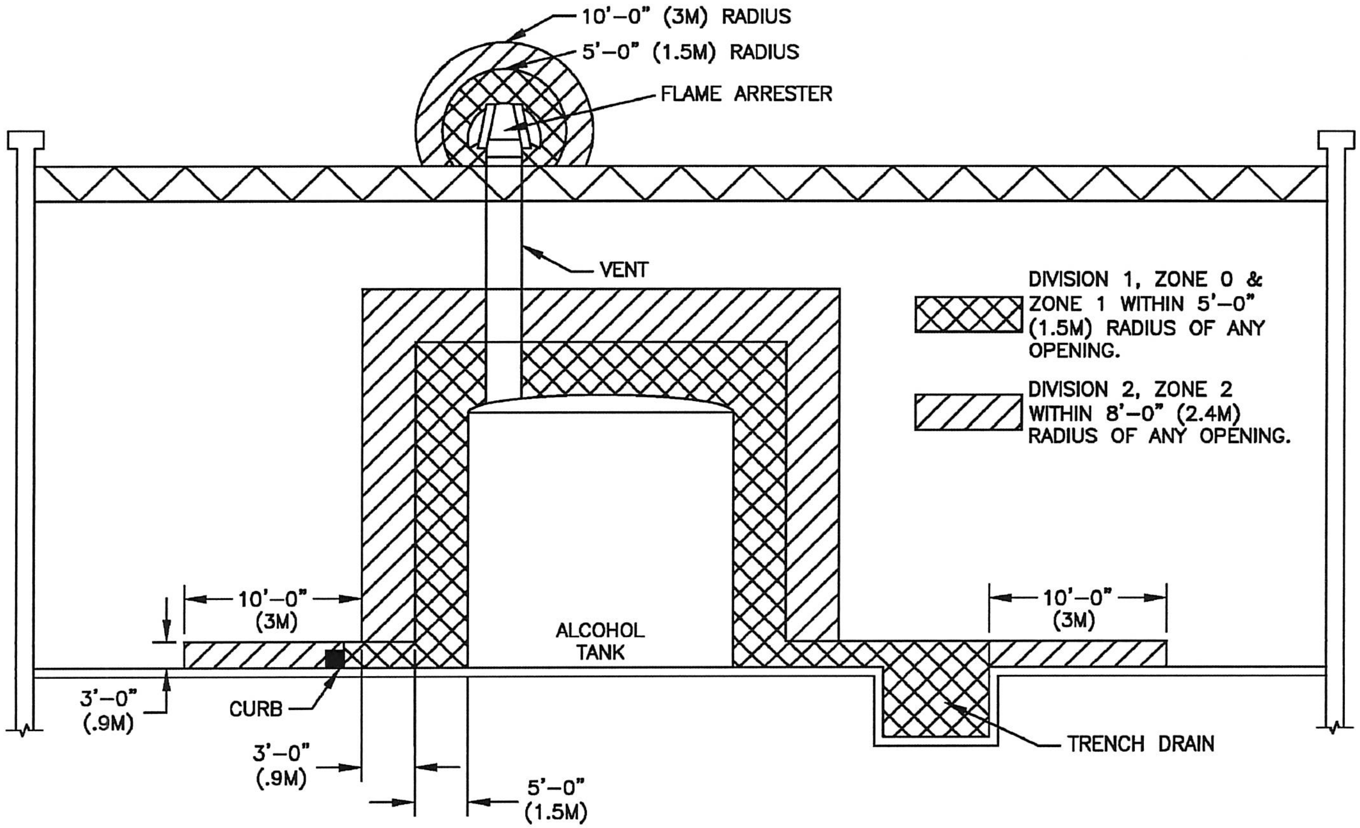


Figure 6-2.1m Indoor Tank With Outdoor Vent

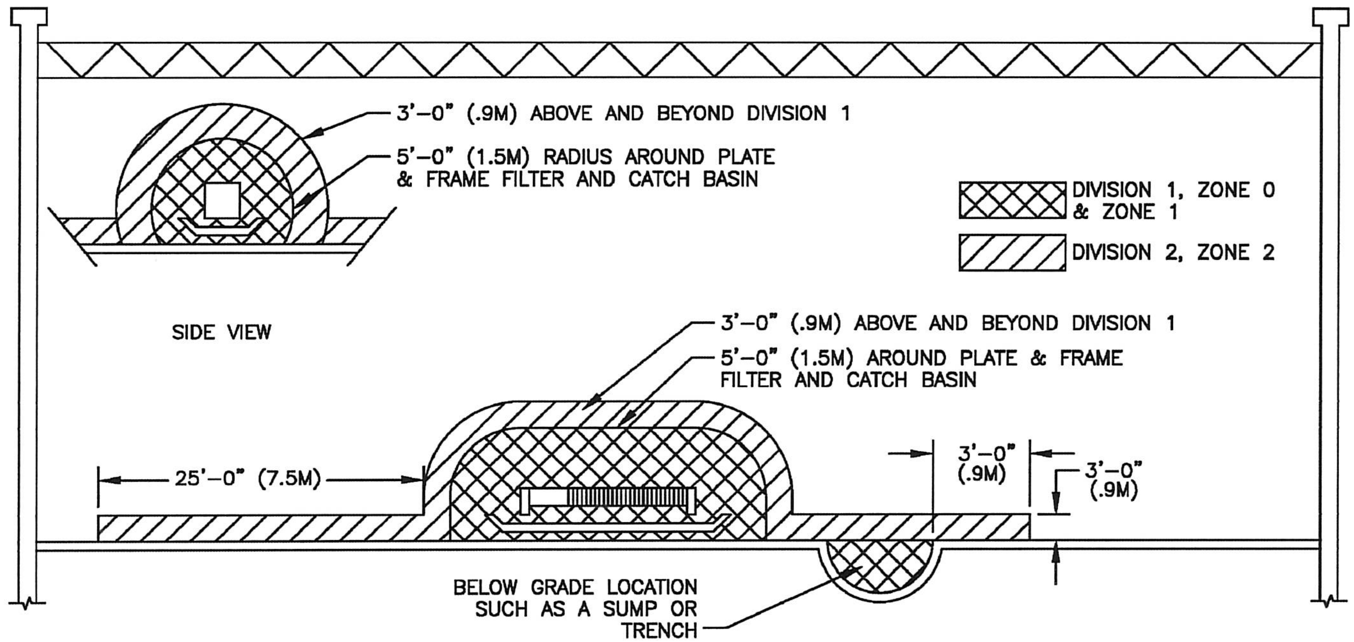


Figure 6-2.1n Plate & Frame Filter

Chapter 7
Equipment

7-1 MECHANICAL HANDLING EQUIPMENT

7-1.1 General. All permanent and portable mechanical handling equipment utilized within classified areas should be designed specifically for the intended exposure with particular attention to electrical apparatus.

7-1.2 Idle Pallets. Idle pallet storage should be located outside of buildings when practical. For storage clearances and protection refer to NFPA 13, *Installation of Sprinkler Systems.*

7-1.3 Plastic Pallets. The use of plastic pallets is not recommended.

7-1.4 Industrial Trucks

7-1.4.1 Power-operated industrial trucks should comply with NFPA 505, *Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance and Operations.*

7-1.4.2 Industrial trucks using liquefied petroleum gas or liquid fuel should be refueled outside of and separated from buildings at a location designed and designated for that purpose. This location should minimize exposure to high temperatures, physical damage, or tampering by unauthorized persons. Full and empty liquefied petroleum gas containers should be stored in a safe place outside of and remote from any pits or recesses. Refer to NFPA 58, *Storage and Handling of Liquefied Petroleum Gases.*

7-1.4.3 Industrial trucks using battery power and operating in Class I, Division 1 or Zone 1 hazardous locations should be type EX. Industrial trucks of either type ES, EE, or EX designation may be used in Division 2 or Zone 2 locations. Trucks utilizing diesel, LPG, or gasoline may be used in Class 1, Division 2 or Zone 2 hazardous locations if designated type DS, DY, GS, LPS, or GS/LPS respectively.

7-1.4.4 Industrial truck battery charging should be done in areas designed for that purpose. The following should be provided: adequate ventilation for dispersal of fumes from charging batteries, sprinklers under any exhaust hoods, and appropriate fire extinguishers. Refer to NFPA 10, *Fire Extinguishers*; NFPA 505, *Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance and Operations*; and NFPA 13, *Installation of Sprinkler Systems*.

7-1.5 Internal Combustion Driven Equipment. Locomotives or other equipment driven by internal combustion engines, except as permitted in Section 7-1.4, "Industrial Trucks", should not be allowed in areas classified as either Division 1 or 2 or Zone 1 or 2.

7-1.6 Racking Equipment. Refer to Chapter 6, Table 6-2.1, for electrical requirements for equipment used to place barrels into racks.

7-1.7 Grain Handling Equipment. In view of the special nature and potential hazards of equipment used within the grain handling areas, refer to Section 3-2, "Grain Handling," or Section 3-5, "Drying" for the specific requirements of that equipment.

7-2 BUILDING SERVICE EQUIPMENT

7-2.1 General. All permanent and portable building service equipment should be designed specifically for the intended exposure with particular attention to those electrical devices used within or passing through hazardous areas that include but are not limited to paging systems, clocks, telephone service data cable and equipment grounding.

7-2.2 Refrigeration Systems.

All refrigeration systems should conform to the recommendations of ANSI/ASHRAE 15-2001, *Safety Standard for Refrigeration Systems.* Refer to Chapter 6 for electrical classifications.

7-2.3 Process and General Heating Equipment

7-2.3.1 Steam and hot water boilers or furnaces present both an ignition and fuel source and consequently should be kept separated from other plant areas, and especially areas with potential dust or vapor hazards. Installations should comply with NFPA 31, *Installation of Oil Burning Equipment*; NFPA 85, *Boiler and Combustion Systems Hazards Code*; and NFPA 54, *Natural Fuel Gas Code*.

7-2.3.2 Process and general heating equipment should not be used within a hazardous area unless specifically designed and approved for that classification.

7-3 Process Equipment and Tools in Hazardous Areas

7-3.1 All process equipment and tools used within a hazardous area should be designed specifically for the intended exposure with particular attention to electrical apparatus. Refer to Chapter 6.

7-3.2 Pumps and other motor-driven or rotating devices should have guards for couplings and belts that are non-sparking.

7-3.3 Air-driven power tools should be used wherever possible instead of electrical tools. When air driven tools are not practical electrical tools may be used if the procedures in Section 8-2.1, "Hot Work" are followed.

Chapter 8
Impairments, Maintenance and Inspections

8-1 IMPAIRMENTS

8-1.1 Impairments to Fire Protection Equipment. Impairments to fire protection equipment expose the facility to a severe loss should a fire occur in the area affected by the impairment. Impairments can be planned or unplanned, depending on the initiating circumstances. In either case, certain actions should be taken to minimize the possibility of loss during the period of the impairment. A written impairment control program will reduce potential confusion, especially during an unplanned impairment, and help ensure proper actions are taken to control the impairment and return systems to service in a timely manner. Refer to NFPA 25, *Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*.

8-1.2 Planned Impairments. A planned impairment typically involves improvements, repairs, or modifications to protection systems. Since such work is usually planned in advance, a schedule can be developed with other operational departments to ensure:

a) Appropriate management is aware of and understands the scope of the planned impairment.

b) When possible, hazardous processes and operations, including unrelated Hot Work, are curtailed prior to protection systems being taken out of service.

c) Parts and materials are available before work is started

8-1.2.1 Impairment Procedures. When handling an impairment, the following actions should be performed:

a) Obtain permission from management.

b) Notify public fire department, plant emergency personnel and authority having jurisdiction of systems to be affected, dates and times of impairments, and anticipated restoration time.

c) Select non-operating hours when possible.

d) Establish temporary protection and take extra precautions in the area of impairment (e.g., provision of additional fire extinguishers, lay fire hoses to areas with impaired sprinklers, add surveillance or fire watch to areas with impaired systems, etc.).

e) Properly "tag out" the impaired systems or equipment per the facility impairment control program.

f) Complete the work in a timely manner

g) Expedite the restoration of protection systems and reopening of all valves upon completion of the work.

h) Notify management and appropriate authorities of system restoration.

8-1.2.2 Unplanned Impairments. An unplanned impairment typically involves emergency or unexpected events impairing the normal function of protection systems. When handling an unplanned impairment, the response actions are time sensitive:

a) Top priority should be given to prompt restoration of complete protection.

b) Notify management of system impairment.

c) Notify public fire department, plant emergency personnel, and authority having jurisdiction of systems affected, time and date of impairment, and anticipated restoration time.

d) Cease, when possible, all hazardous processes, operations, and unrelated Hot Work in the impaired area.

e) Isolate the impaired area through use of control valves (e.g. main, sectional, and divisional valves).

f) Establish temporary protection and take extra precautions in the area of impairment (e.g., provision of additional fire extinguishers, lay fire hoses to areas with impaired sprinklers, add surveillance or fire watch to areas with impaired systems, etc.).

g) Properly "tag out" the impaired systems or equipment per the facility impairment control program.

h) Complete the work in a timely manner

i) Expedite the restoration of protection systems and reopening of all valves upon completion of the work.

j) Notify management and appropriate authorities of system restoration.

k) Initiate appropriate actions to prevent recurrence of the impairment.

8-2 MAINTENANCE

8-2.1 Hot Work. Due to the hazardous nature of Hot Work, this section is performance oriented.

8-2.1.1 Hot Work is an ignition source. To help prevent fires from Hot Work, management should develop and implement a Hot Work Program that clearly states procedures, responsibilities, and accountabilities. The program should apply to employees and contractors. Those designated in the program as having Hot Work responsibilities/accountabilities for requesting, contracting, supervising, authorizing, and/or doing Hot Work should understand all provisions of the program applying to them before being involved with Hot Work. It is also important that they be knowledgeable about and fully appreciate the fire potentials involved with Hot Work.

8-2.1.2 The Hot Work Program should require a mandatory Hot Work Permit system. Hot Work done in other than a "safe hot work area", such as a maintenance or welding shop, should always require a Hot Work Permit that authorizes the Hot Work to be done. A Hot Work Permit should be designed to require the signatures of those designated by management to authorize Hot Work. It should also list the fire prevention measures that must be followed for the Hot Work job it is authorizing. Refer to Appendix E, "Sample Hot Work Permit," for an example.

8-2.1.3 Although management's written Hot Work Program and the fire prevention measures listed on the Hot Work Permit should be thorough, it should be assumed they are not all inclusive. Consequently, those designated to authorize Hot Work should be held accountable for applying (on a case by case basis) additional fire prevention measures as appropriate for the Hot Work being requested. Resources for determining what and when additional measures should be applied include principles/provisions discussed in NFPA 51B, *Fire Prevention During Welding, Cutting, and other Hot Work.*

8-2.1.4 Facility personnel should monitor all contractors to ensure Hot Work procedures and responsibilities presented in the Hot Work Program are followed along with adherence to fire prevention measures on the Hot Work Permit.

8-2.1.5 Hot Work within or near hazardous areas is not recommended but there will be times when alternatives are not feasible. In such cases, the person(s) authorized to issue Hot Work Permits should visit the proposed work site to determine what site / substance specific fire prevention measures are necessary. Some of these more specific fire prevention measures for hazardous areas are listed below. Refer to Appendix E, "Sample Hot Work Permit."

a) Prohibiting or limiting arc welding/cutting, open flame, and spark producing Hot Work within or near a hazardous area by determining feasibility of alternatives, e.g., remove the equipment to be worked on from the area, prefabricate outside the area and install with hand tools, and use nonflame/non-spark producing tools and work methods insofar as if possible.

b) Properly trained Fire Watch Personnel should be maintained throughout the operation and for at least thirty (30) minutes after the Hot Work is completed.

c) Close all interior doors, tank hatches and any open product containers.

d) Open all exterior doors for ventilation. Turn on all ventilation systems.

e) Have fire extinguishers, blankets and related equipment handy; know where fire hoses are located.

f) If existing alcohol product piping is to be welded or soldered, it shall be positively shut off and locked out, drained, blown or rinsed clear of all vapors with compressed air and dams inserted upstream of potential flow to assure a clean pipe free of alcohol or alcohol vapors.

g) Rescheduling (if feasible) the work for a different time, e.g., during a process shut-down when variables can be more closely controlled or perhaps eliminated.

h) Performing vapor detection meter testing to ensure that the atmosphere does not exceed 0% of the LFL. Alcohol vapors tend to stratify; therefore testing should be performed at multiple locations and elevations within the Hot Work area. (Note: Instrumentation for testing should be calibrated to the substance being tested for, e.g., alcohol. Also, it should be approved for the atmosphere(s) in which it will be used.).

i) Ensuring the personnel performing the Hot Work understands that work must immediately stop should there be an adverse change in condition.

j) Prohibiting transfer of flammable liquids, flammable gases, or dust producing processes such as grain handling within the area and ensuring transfer cannot be resumed without the permission of the accountable person.

8-2.2 Entering Tanks. There are times when entering flammable liquid tanks cannot be avoided, i.e., for repair, inspection, preventative maintenance, etc. If Hot Work is to be done, applicable Hot Work Permit protocols and fire prevention measures should be followed. Refer to Section 8-2.1, "Hot Work". Regardless of whether or not Hot Work is to be done, other rules and regulations should be complied with, e.g., Confined Space Entry and Lock-out / Tag out procedures.

8-2.3 Flammable Liquid Piping Systems. All pipe leaks should be repaired and spills cleaned up promptly to minimize the release of vapors or liquids to the atmosphere or occupied areas.

8-2.4 Fumigation. Fumigation operations should be performed in accordance with procedures and practices contained in Annex C of NFPA 61, *Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities.*

8-2.5 Electrical. Electrical equipment maintenance should comply with NFPA 70B, *Electrical Equipment Maintenance*.

8-2.6 Water Based Fire Protection Systems and Fire Hoses. Maintain in accordance with NFPA 25, *Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, and NFPA 1962, *Inspection, Care, and Use of Fire Hose, Couplings and Nozzles and the Service Testing of Fire Hose*.

8-2.7 Other Extinguishing Systems. Maintain specialized extinguishing systems, such as dry chemical, carbon dioxide, clean agents, or self-contained extinguishing units in accordance with NFPA 12, *Carbon Dioxide Extinguishing Systems;* NFPA 17, *Dry Chemical Extinguishing Systems;* NFPA 2001, *Clean Agent Fire Extinguishing Systems.*

8-2.8 Bonding and Grounding. Bonding and grounding components (cables, clamps, etc.), spirit storage and transfer equipment (tank trucks, tank cars, pipes, hoses, downspouts, loading rack, connectors, nozzles, sensors, etc.) and equipment used for protection against static hazards should be inspected and tested.

8-2.8.1 Visual inspection should be performed monthly and include verifying the attachments of bonding and grounding components, and the absence of excessive corrosion.

8-2.8.2 Testing should be performed annually and include verifying resistance to ground for both bonding and grounding components, storage and transfer system components including all sections that may be electrically discontinuous (e.g., flange connections with insulating gaskets). Resistance to ground for bonding and grounding components should be less than 10 ohms. Resistance specifications may be more stringent when the same components are also used for protection against stray currents and lightning. Refer to NFPA 77, *Recommended Practice on Static Electricity* and API Standard 2003, *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents.*

8-2.9 Ventilation Systems. Equipment in enclosed processing areas may deteriorate over time and periodic sampling should be conducted to ensure that leakage rates are manageable and the ventilation rate is adequate for any increase in leakage rates.

8-2.10 Tank Maintenance

8-2.10.1 All alcohol handling tanks and associated equipment should be properly inspected, tested and maintained to prevent the accidental discharge of their contents under normal operating conditions.

8-2.10.2 All conservation vents, flame arresters, and emergency relief vents (excluding rupture disks) should be cleaned and checked for proper operation on an annual basis.

8-2.10.3 These regular inspections of aboveground storage tanks and their appurtenances, performed in accordance with national standards, provide a means to ensure system maintenance. Acceptable standards include, but are not limited to, the following:

(1) API 653, *Tank Inspection, Repair, Alteration, and Reconstruction*
(2) STI SP001-01, *Standard for Inspection of In-Service Shop Fabricated Aboveground Tanks for Storage of Combustible and Flammable Liquids*
(3) API 12R1, *Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service*
(4) API 2350, *Overfill Protection for Storage Tanks in Petroleum Facilities*

8-3 INSPECTIONS

8-3.1 Self-Inspections. Self-inspection of facility fire protection devices and equipment should be assigned to trained and designated employees. Inspection frequency should not be less than required by the authority having jurisdiction. Resources that may be helpful in developing a written and documented self-inspection program include appropriate NFPA References. Refer to NFPA 10, *Portable Fire Extinguishers*, NFPA 20, *Installation of Stationary Pumps for Fire Protection*, NFPA 25, *Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.*

8-3.1.1 Inspection reports should be submitted to management for review, deficiency correction, planning and retention. Refer to Appendix F, "Sample Self-Inspection Form for Fire Prevention." It lists many of the items that should be included in a self-inspection program.

8-3.2 Fire Alarm Systems. Programs to inspect, test, and maintain the alarm components and systems are necessary to ensure continued reliability of the system and should be established at a facility. Refer to NFPA 72, *National Fire Alarm Code* and NFPA 101, *Life Safety Code.*

8-3.3 Yard Exposures. Inspection and maintenance programs for the clear space around buildings and structures should ensure grasses are mowed, dead and/or downed trees, tree limbs, branches, and leaves are removed, and trees and brush are periodically thinned and pruned. Removal of ground litter, trash, and other debris should also be a component of the inspection and maintenance program.

8-3.3.1 For grass exposures, grass should be kept mowed to a height of 4 inches (100 mm) or less for at least 30 feet (9 m) from the structure.

8-3.3.2 For light brush and small tree exposures, the clear space around structures should be at least 50 feet (15 m) wide.

8-3.3.3 For forest and heavily wooded area exposures, the clear space from structures should be at least 100 feet (30 m) wide.

8-3.3.4 Exterior storages should be prohibited in close proximity to structures. This includes empty barrels, idle pallets, or other combustible materials. Typical minimum clearance distance should be at least 50 ft (15 m), but may vary depending of type and quantity of materials stored. Refer to Section 3-9, "Empty Wooden Barrel Storage".

8-3.4 Storage Practices

8-3.4.1 All operating areas of the facility should be kept free of accumulated debris, dust, oily rags, improperly stored paints and solvents, and other unnecessary supplies or combustible materials that may provide a source of fuel in the event of a fire.

8-3.4.2 Maintenance supplies (e.g., aerosols, lubricants, paints, etc.) should be stored in locations separate from operating areas and in cabinets or enclosures, specifically designed for storage of the materials, to minimize exposure to high temperatures, physical damage, or tampering by unauthorized persons.

8-3.4.3 Storage of unused combustible materials and unused equipment should be remote from operating areas and occupancies, have aisle-ways between stored items, and protected by automatic sprinklers.

8-3.5 Rubbish and Trash Handling

8-3.5.1 Approved containers for rubbish and trash materials should be provided and contents removed from the buildings and property at frequent intervals. Refer to NFPA 82, *Incinerators and Waste and Linen Handling Systems and Equipment.*

8-3.5.2 Hazardous and biological wastes should be disposed of in a separate approved manner.

8-3.6 Smoking. Smoking should be prohibited except in designated areas.

Chapter 9
Emergency Planning

9-1 GENERAL

9-1.1 Each facility should have an Emergency Plan with personnel trained and equipped to deal quickly and effectively with anticipated emergency situations. The Emergency Organization (EO) provides an appropriate means of implementing an Emergency Plan for providing control in an emergency situation. Emergency procedures must be preplanned for good fire protection, and these include discovery, mobilization, fire-fighting operations, and employee training.

9-2 PLANNING

9-2.1 Pre-emergency planning is a major item in establishing a workable emergency plan. Emergency planning depends upon the requirements that must be met and upon the many variables involved at any given location. Good planning should minimize confusion and contribute to quick recovery from any emergency. The plans should be formulated with definite goals and should assure continuity of operations.

9-2.2 Up-to-date information concerning the location of important valves, electrical controls, doors, pipelines, utility feeds, fire water mains, tanks, hazardous materials, and major equipment and a general facility layout should be available for immediate use. This information could be in the form of drawings, lists, sketches, or photographs. An extra set should be available in a secure place.

9-2.3 The Plan should also be coordinated with local agencies and with adjacent industrial organizations. Tours should be established to familiarize the agencies and organizations with the various buildings, processes, and hazards within the facility.

9-3 EMERGENCY ACTIVITIES

9-3.1 The Pre-Emergency Plan should:

a) Establish an area organization plan.

b) Establish a public authority notification plan.

c) Establish a call procedure for key employees.

d) Make available current written procedures that will allow for the safe shutdown of various plant equipment. Copies of these procedures should be kept in the production areas for immediate reference.

e) Assure that organization personnel are informed and trained in the Emergency Plan.

f) Prepare a checklist for the efficient execution of the Emergency Plan.

g) Include a prepared directive type order to inform employees in the event the evacuation is ordered.

h) Establish a plan for an effective salvage operation.

9-3.2 During emergencies, the following actions should be taken as appropriate:

a) Notify local facility personnel and fire department.

b) Evacuate personnel from facility.

c) Provide adequate direction to the fire department and other emergency services when they arrive on the scene.

d) Ensure full operation of protection facilities such as sprinklers, fire pumps, valves, etc.

e) Ensure fire doors are closed upon evacuation.

f) Reduce hazards in the affected areas.

g) Shutdown processes as needed.

9-3.3 Post-Emergency Activities

9-3.3.1 Protection should be immediately restored. This pertains to sprinklers, pumps, watchmen service, alarm systems, etc.

9-3.3.2 Salvage plans should be put into operation and may include:

a) Replace sprinklers that have operated and repair broken pipes.

b) Separate damaged and undamaged property.

c) Protect the facilities and contents from the elements (e.g., tarpaulins) and intruders (e.g., temporary fencing or guard service).

d) Wipe oil on machinery to reduce rusting.

e) Remove motors, switchgear, controllers, etc. and dry out these devices.

f) Remove water, especially in case goods and grain areas.

9-3.3.3 A full investigation of the occurrence should be made with a written report submitted to management outlining all details of the loss and what corrective measures can be taken to prevent recurrence of the incident.

9-4 EMERGENCY ORGANIZATION

9-4.1 An Emergency Organization should be considered for all facilities. Personnel who are familiar with the facilities, fire-fighting techniques, fire-fighting equipment, and the capabilities and operation of the public fire department should be trained and assigned the following responsibilities as appropriate:

a) Person to take charge during emergency situation

b) Public fire department notification and direction.

c) Fire pump operation.

d) Process equipment shutdown.

e) Evacuation supervision.

f) Sprinkler and protection systems valve monitoring

g) Salvage operations

9-5 WATCH SERVICE

9-5.1 Watch service personnel, when provided, should, at a minimum, be properly instructed to notify the appropriate authorities and provide directions to the public fire department. Additional responsibilities could include familiarity with the use of fire extinguishers and the operation of protection systems, control valves, fire pumps, etc.

Appendix A
Characteristics of Flammable and Combustible Liquids

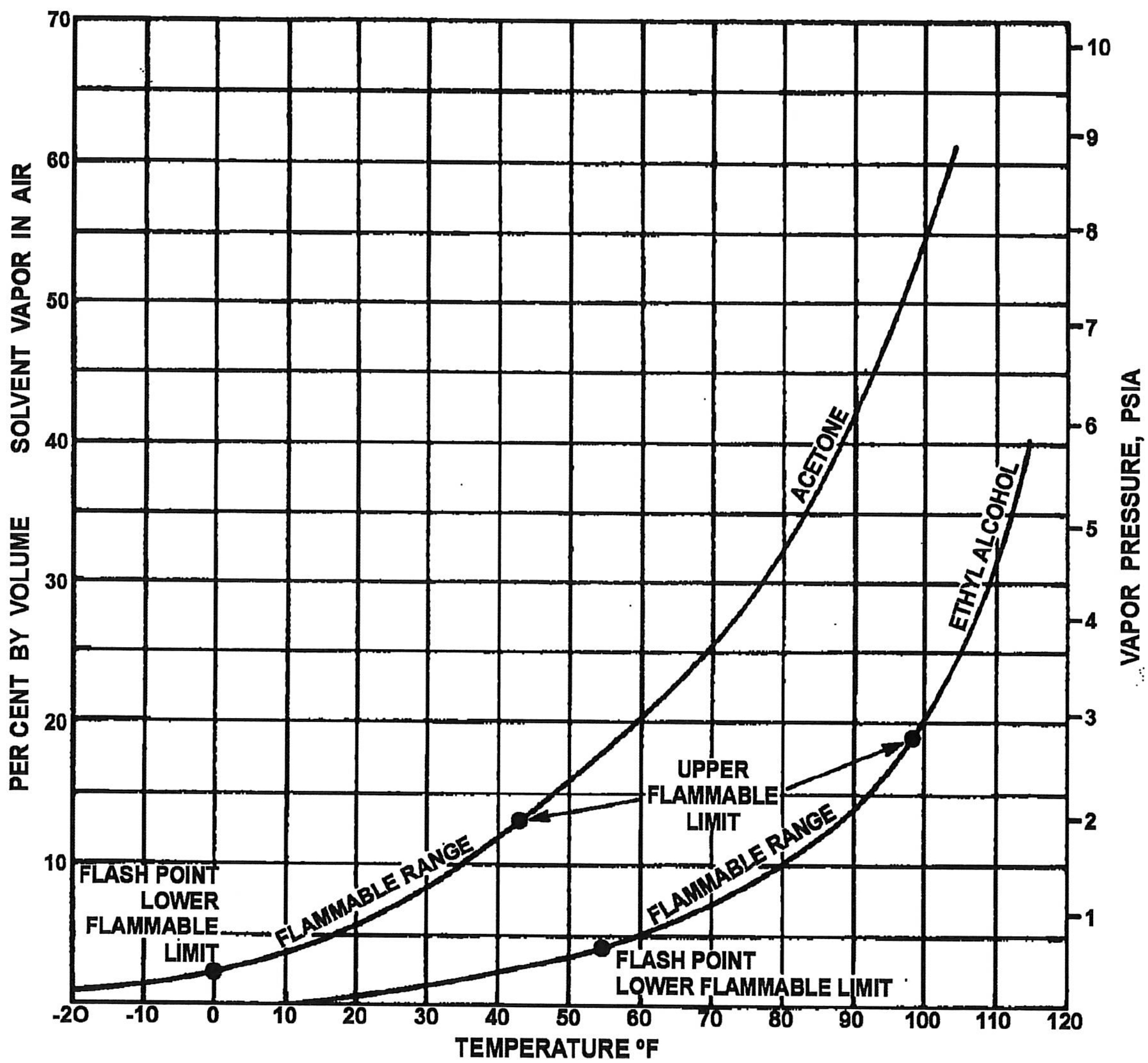


Figure A-1 Relationship between flash point, flammable limits, temperature, and vapor pressure for acetone and ethyl alcohol. Liquid, vapor, and air in a closed container at normal atmospheric pressure

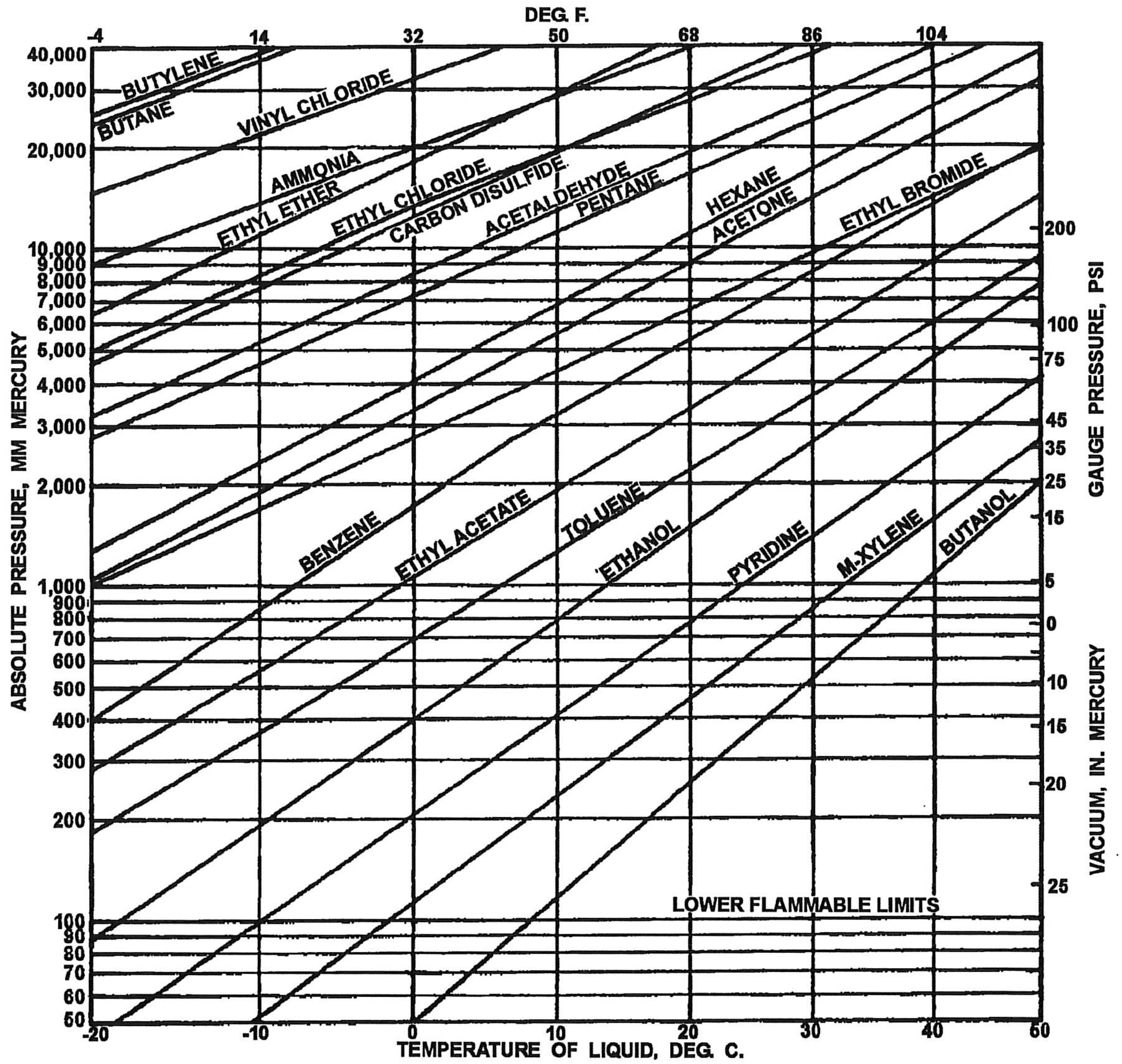


Figure A-2 Variation of lower flammable limits with temperature and pressure

This chart is applicable only to flammable liquids or gases in equilibrium in a closed container. Mixtures of vapor and air will be too lean to burn at temperatures below and at pressures above the values shown by the line on the chart for any substance. Conditions represented by points to the left of and above the respective lines are accordingly nonflammable. Points where the diagonal lines cross the zero gauge pressure line (760 mm of mercury absolute pressure) indicate flash point temperatures at normal atmospheric pressure.

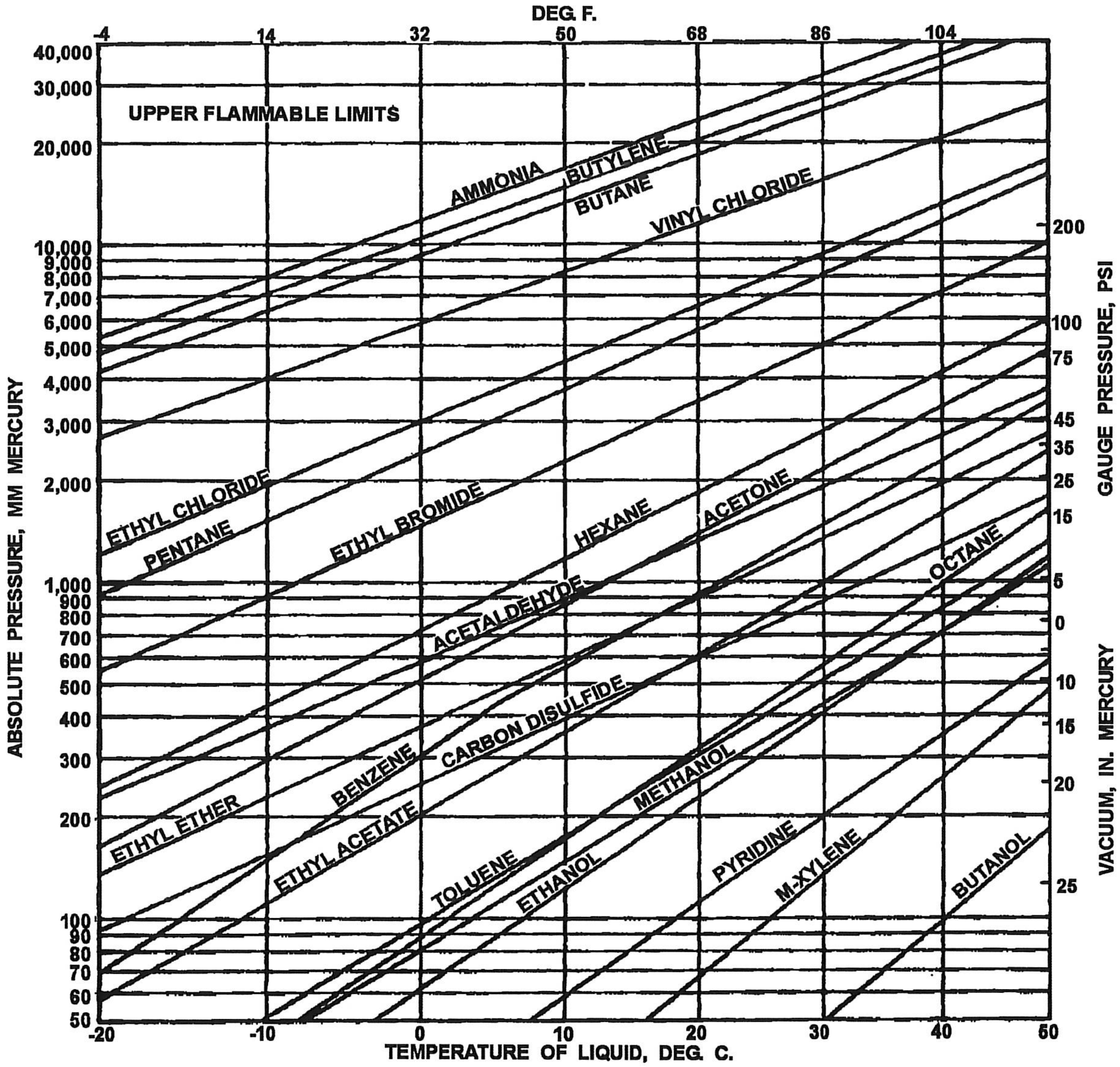


Figure A-3 Variation of upper flammable limits with temperature and pressure

This chart is applicable only to flammable liquids or gases in equilibrium in a closed container. Mixtures of vapor and air will be too "rich" to be flammable at temperatures above and pressures below the values shown by the lines on the chart for any substance. Conditions represented by points to the right of and below the respective lines are accordingly nonflammable.

Appendix B
Dust Properties

Table B-1
Dust Properties

Material	Maximum Pressure psi	(kPa)	Explosion Pressure Maximum Rate of Pressure Rise psi/sec	(kPa/sec)	Ignition Temperature °F	(°C)	Minimum Explosion Concentration oz/ft^3	(gm/m^3)	Energy to Ignite joules	Limiting Oxygen Percentages to Ignite in Inert Atmospheres CO_2
Agricultural Products										
Alfalfa meal	66	(459)	1,100	(7,590))	986	(530)	0.105	(105)	0.32	11
Cornstarch (-325 mesh)	145	(1,000)	9,500	(65,550)	752	(400)	0.045	(45)	0.04	
Grain Dust (Corn, etc.)	131	(903)	7,000	(48,300)	806	(430)	0.055	(55)	0.03	15
Soy Flour	94	(647)	800	(5,520)	1,022	(550)	0.060	(60)	0.10	
Carbon and Coal										
Coal, Penn. bituminous	90	(621)	2,300	(15,870)	1,130	(610)	0.055	(55)	0.06	
Coal, Penn., anthracite	0	(0)	0	(0)						
Charcoal, hardwood	83	(572)	1,300	(8,970)	986	(530)	0.140	(140)	0.02	
Graphite	0	(0)	0	(0)	1,076	(580)				
Wood, Birch bark	103	(710)	7,500	(51,750)	842	(450)	0.02	(20)	0.06	
Chemicals										
Fumaric acid	103	(710)	3,000	(20,700)	968	(520)	0.085	(85)	0.035	
Stearate, aluminum	87	(600)	6,300	(43,470)	788	(420)	0.015	(15)	0.015	
Sulphur	75	(538)	4,700	(32,430)	376	(190)	0.035	(35)	0.015	12

NOTES:
Source: Various reports of the U.S. Department of Interior, Bureau of Mines, by various authors.
Hartmann apparatus used, at 8 to 12 psi (55 to 83 kPa) dispersed pressure; concentration 0.50 oz/ft^3 (500 gm/m^3).

Comment 32C

Appendix C
Sample Self-Inspection Form
Grain Storage Facilities

Self-Inspection Form Grain Storage Facilities - Page 1 of 3

Plant: ______________________________

Location: ______________________________ Date: ______________

INSPECTION REPORT

Weekly use of this report to supplement PLANT FIRE PREVENTION INSPECTION is recommended.

HOUSEKEEPING

Good housekeeping and clean premises are the basic essentials in reducing the dust explosion potential. Secondly, it should be emphasized that any potential fire cause may also be the initiating factor for an explosion. Dust should not be present in greater than trace amounts and care exercised to prevent continuity throughout the facility.

	Yes	No*	Comments
INSIDE			
Check "Yes" if dust does not exceed trace amounts on walls, floors, overheads, shafts, or tunnels (basements) ☐	☐	☐	
If "No", use back to describe accumulations: depth, extensiveness, and whether continuous from one area to another.			
Clean-down by brushing, vacuuming, and sweeping?	☐	☐	
Blow-down with compressed air prohibited?	☐	☐	
Are machinery and equipment, mechanical and electrical, clean?	☐	☐	
Are waste cans for oily rags and debris provided and emptied daily?	☐	☐	
OUTSIDE			
Are roofs, areas at cyclones, dryers, and grain dumps clean?	☐	☐	
Are combustibles, rubbish, and weeds kept well away from buildings?	☐	☐	

REPAIR AND MAINTENANCE

	Yes	No*	Comments
BUILDINGS			
Are interior-floors, ceiling, partitions, and walls in good shape?	☐	☐	
Are exterior walls, windows, doors, roofs, and canopies in good repair?	☐	☐	
MACHINERY AND EQUIPMENT			
Is grain-handling equipment tight and in good repair?	☐	☐	
Is dust-collecting equipment unplugged, tight, and in good repair?	☐	☐	
Are bearings, gears and pulleys oiled and running cool and true?	☐	☐	
Are magnets operating and are they emptied regularly?	☐	☐	
Are grain dryer combustion safety controls operating? Screens clean?	☐	☐	

*** If "No" – Explain under comments and list specific recommendations for correction on back.**

Reprinted with the permission of the Industrial Risk Insurers.

Self-Inspection Form Grain Storage Facilities - Page 2 of 3

REPAIR AND MAINTENANCE

MACHINERY AND EQUIPMENT (cont'd)

- Is aerating equipment in good repair and operating satisfactorily? ☐ ☐
- Is inerting system in good condition and operating satisfactorily? ☐ ☐
- Are ventilating systems operating effectively? ☐ ☐
- Are leg and conveyor motion switches in service and tested? ☐ ☐
- Are tripper connections tight? Are ducts clear and proper gates closed? ☐ ☐
- Are the bag collectors operating properly and are the bags clear? ☐ ☐

ELECTRICAL EQUIPMENT

- Are transformers regularly services? Not leaking oil? Cool? ☐ ☐
- Are panelboard, switch and controller covers in place? Cool? ☐ ☐
- No oversizing, bridging of fuses and relays? ☐ ☐
- Are motors running at a safe temperature? ☐ ☐
- Are protective globes in place on lights? ☐ ☐
- Are extension cords and plugs okay? ☐ ☐
- Is all wiring in good condition? (No temporary wiring?) ☐ ☐
- Class II electrical equipment where necessary? ☐ ☐

FIRE SAFETY PROGRAM

- Is "No Smoking" rule enforced and are No Smoking Signs posted? ☐ ☐
- Is a Hot Work permit system being followed? If no Hot Work, leave blank. ☐ ☐
- Is Shutdown Procedure posted and enforced? If not Shutdown, leave blank ☐ ☐
- Are grain or feed temperatures or both recorded and satisfactory? ☐ ☐
- Are lube oils, gasoline, insecticides, and fumigants safely handled? ☐ ☐
- Are Fire Department Notification Procedures posted? ☐ ☐
- Is Watch Service for night, weekend, and holiday supervision adequate? ☐ ☐
- Is Outside Contractor Supervision satisfactory? ☐ ☐
- Is jogging or leg belt prohibited when bucket elevator becomes choked? ☐ ☐
- Are standpipes and hoses in place and in good condition? ☐ ☐
- Are extinguishers in place? Charged? Protected from freezing? ☐ ☐

HEATING FACILITIES

- Are combustion safety controls on boilers and heaters operating? ☐ ☐
- Are steam pipes, radiators, and heaters clear of combustibles? ☐ ☐
- Is fuel supply safely stored? Is system tight without any leaks? ☐ ☐

*** If "No" – Explain under comments and list specific recommendations for correction on back.**

Self-Inspection Form Grain Storage Facilities - Page 3 of 3

COMMENTS FOR MANAGEMENT ATTENTION

List here all necessary housekeeping, maintenance, repairs or replacements, any undesirable conditions, and any suggestions for improving fire protection or the reduction of any potential fire hazards.

Inspected by:	______________	Position:	______________	Date:	__________
Checked by:	______________	Position:	______________	Date:	__________

Indicate below the analysis date of work orders, and progress report or data when reported defects were rechecked and found corrected.

Appendix D
National Electrical Code Criteria and Equipment Considerations

D-1 SCOPE

D-1.1 Article 500 of the NEC defines locations in which flammable vapors are or may be present as Class I. Locations that are hazardous because of the presence of combustible dust are Class II.

D-1.2 The locations in each of these classes are further classified by "divisions" according to the degree of hazard.

D-2 CLASS I LOCATIONS

D-2.1 Class I locations are those in which flammable gases or vapors are or may be present in air in quantities sufficient to produce ignitable mixtures.

D-2.2 Division 1: The criterion for these locations is that they are likely to have flammable gases or vapors present under normal conditions.

D-2.3 Class I, Division 1 locations are locations where:

a) hazardous concentrations of flam¬mable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions;

b) ignitable concentrations of flammable gases or vapors that may exist frequently because of repair or maintenance operations or leakage;

c) hazardous concentrations of flammable gases or vapors may be released because of breakdown or faulty operation of equipment processes and might cause simultaneous failure of electrical equipment.

D-2.4 Installations for Division 1 areas use explosion-proof equipment, which is designed so that operation or failure of any portion of the electrical system, even though causing vapor ignition within the housings, will not release flame or hot gases so as to ignite the surrounding atmos-phere. Equipment and associated wiring approved as intrinsically safe may be used without explosion-proof housings.

D-2.5 In many instances, this Division classifi-cation applies only to part of a building or room. Each room, section, or other area should be considered individually. Under normal operating conditions, sufficient mechanical ventilation is often provided to eliminate the possibility of an ignitable mixture. The flammable vapor concentration is usually maintained at less than 25% of the LFL. In such uses (except those enumerated below or similar ones) the area is a Class I, Division 2 location.

D-2.6 Division 2: The criterion for these locations is that they are likely to have flammable vapors present only under abnormal conditions, such as the failure or rupture of equipment.

D-2.7 Class I, Division 2 locations are locations where:

a) volatile flammable gases are handled, processed, or used, but in which the hazardous materials will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture, breakdown, or abnormal operations;

b) hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, but which might become hazardous through failure or abnormal operation of the ventilation equipment; or

c) adjacent to Class I, Division 1 locations. Hazardous concentrations of gases or vapors might occasionally be communicated to these adjacent areas unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

D-2.8 Class I, Zone 0 locations are locations where:

a) ignitable concentrations of gases or vapors that are present continuously;

b) ignitable concentrations of flammable gases or vapors that are present for long periods of time.

D-2.9 Class I, Zone 1 locations are locations where:

a) ignitable concentrations of flammable gases or vapors that are likely to exist under normal operations;

b) ignitable concentrations of flammable gases or vapors that may exist frequently because of repair or maintenance operations or leakage;

c) equipment that is operated or processes that are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors, and that also could cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition;

d) adjacent to a Class 1, Zone 0 location from which ignitable concentrations of vapors could be communicated, unless communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

D-2.10 Class I, Zone 2 locations are locations where:

a) ignitable concentrations of flammable gases or vapors that are not likely to occur in normal operation, and if they do occur, they will exist only for a short period;

b) volatile flammable liquids, flammable gases or flammable vapors that are handled, processed, or used, but in which the liquids, gases, or vapors normally are confined within closed containers or closed systems from which they can only escape as a result of accidental rupture or breakdown of the containers or system, or as the result of the abnormal operation of the equipment with which the liquids or gases are handled, processed or used;

c) ignitable concentrations of flammable gases or vapors that normally are prevented by positive mechanical ventilation, but that may become hazardous as the result of failure or abnormal operation of the ventilation equipment;

d) adjacent to a Class 1, Zone 1 location from which ignitable concentrations of vapors could be communicated, unless communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

D-3 CLASS II LOCATIONS

D-3.1 Class II locations are those that are hazardous because combustible dusts are present.

D-3.2 Class II, Division 1 locations are locations where:

a) combustible dust is or may be in suspension in the air continuously, intermittently, or periodically under normal operating conditions, in quantities sufficient to produce ignitable mixtures;

b) mechanical failure or abnormal operation of equipment might cause such mixtures to be produced, and might also provide a source of ignition through simultaneous failure of equipment, or from other causes; or

c) combustible dusts of an electrically conducting nature may be present.

D-3.3 Class II, Division 2 locations are locations in which combustible dust will not normally be in suspension in the air, or will not be likely to be thrown into suspension in quantities sufficient to produce explosive mixtures by the normal operation of equipment. In these locations:

a) accumulations of combustible dust may be sufficient to interfere with the safe dissipation of heat from electrical apparatus; or

b) accumulations of combustible dust on, in, or in the vicinity of electrical equipment might be ignited by arcs, sparks, or burning material from such equipment.

D-4 Non-classified Area

D-4.1 Locations that are not classified as Division 1 or 2 or Zone 0, 1, or 2 are considered non-classified.

D-4.2 Experience has shown that the release of flammable vapors or dust from some operations and apparatus is so infrequent that it is not necessary to classify the surrounding locations where flammable gases and volatile liquids are processed, stored, or handled such as: areas that have adequate ventilation, where combustible materials are contained within suitable, well-maintained, closed piping systems; areas that lack adequate ventilation, but where piping systems are without valves, fittings, flanges, and similar accessories that may be prone to leaks; areas where combustible materials are stored in suitable containers.

D-5 Intrinsically Safe Electrical Equipment for Hazardous Locations

D-5.1 The National Electrical Code recognizes intrinsically safe electrical equipment and its wiring.

D-5.2 Intrinsically safe equipment and wiring are incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to ignite a specific hazardous atmosphere mixture in its most easily ignited concentration.

D-6 NEC Grouping of Atmospheric Mixtures with Similar Flammable Characteristics

D-6.1 Groups A through D consist of flammable gases or vapors. They are classified according to:

a) their inability to propagate flame through a flanged joint;

b) their ignition temperatures; and

c) in some cases, their ignition energies.

Ethyl alcohol is classified Group D.

D-6.1 Groups E through G consist of atmospheres containing various combustible dusts. Grain dust is included in Group G.

Appendix E
Sample Hot Work Permit

HOT WORK PERMIT

(Permit must be posted at job site)

This Permit is valid only on ______________________ during the ____________________ shift.

The location is restricted to: ____

The work to be done is: ____

____

Area must be checked and each item below marked YES or N/A by a Security Officer. If a NO is initialed, Hot Work will not start until item can be either marked YES or okayed by the Security Director, Plant Engineer or Safety Manager.

		YES	NO	N/A
1.	Sprinkler system is operative?	☐	☐	☐
2.	Flight of sparks/slag are shielded?	☐	☐	☐
3.	Combustibles moved 35' or covered?	☐	☐	☐
4.	Floor and wall opening holes plugged?	☐	☐	☐
5.	Pipes/ducts that can provide avenue for sparks & slag covered or blanked?	☐	☐	☐
6.	Heat conduction safe guards in place?	☐	☐	☐
7.	Heat resistant shields used?	☐	☐	☐
8.	Conveyors have been locked out?	☐	☐	☐
9.	Lint, debris and lubricants removed?	☐	☐	☐
10.	Combustible floors/roofs wetted?	☐	☐	☐
11.	Sprinkler heads protected?	☐	☐	☐
12.	Vertical shafts at least 35' away?	☐	☐	☐
13.	Fire extinguishers at work site?	☐	☐	☐
14.	Fire Watch is qualified?	☐	☐	☐
15.	Smoke detector(s) disarmed?	☐	☐	☐
16.	If hot work is in a hazardous location, are instructions from the Fire Hazard Team attached?	☐	☐	☐
17.	Vapor monitoring done and reads zero?	☐	☐	☐
18.	Continuous vapor monitoring provided?	☐	☐	☐
19.	Health hazards considered?	☐	☐	☐
20.	Hot work away from air intake?	☐	☐	☐

Requesting Authority: ______________ (Signature)	☐	Project Engineer or Maintenance Supervisor
Operator: ______________ (Signature)	☐	Contractor or Owner
Supervisor of area: ______________ (Signature)	☐	Supervisor or Manager
Fire Watch(s): ______________ (Signature)	☐	Employee ☐ Contractor Security Officer

WHEN THE JOB IS COMPLETE, CALL SECURITY

Date: ______________ Shift: ______________ Location: ______________

Time Issued: ______________ Description of Work: ______________

Signature of Security Officer Initialing This Checklist: ______________ No. 0201

HOT WORK is:

The use of either arc or open flame welding and cutting equipment, other open flame tools, equipment and devices, or spark producing tools. Also, Hot Work is the use of heat generating and/or ordinary electric tools, equipment and devices in "Hazardous Areas".

Examples of these include, but are not limited to:

Internal Combustion Engines	Portable Electric Tools	Grinding or Abrasive Buffing/Polishing
Drilling	Chipping	Sand Blasting
Freeing Seized Bearings	Soldering	Electric Displays
Portable Propane or Electric Heaters	Discharging Photographic Flash Bulbs	Gas Welding or Brazing
Holiday Decorations	Electric Arc Welding	Non-Explosion Proof Electrical Device Use
Torch Cutting or Use		

HAZARDOUS AREAS are:

Locations in which it is reasonable to expect an explosive atmosphere (vapor, gas or dust) does or could exist, i.e., locations where flammable liquids, flammable gases, or combustible dust producing materials either are or have been transferred, processed, manufactured, produced, stored or otherwise used.

Examples of these include, but are not limited to:

1. Locations requiring National Electric Code Class I or II electrical switches, equipment and appliances.
2. Locations where whiskey or other alcohol vapors are either present or can be expected to be present. Examples of these locations include, but are not necessarily limited to: Tank Rooms, Exterior Tanks, Tank Cars and Trucks, Exterior Areas near Alcohol Storage/Processing Areas, and the Bottle Filling Machine Areas.
3. Whiskey or alcohol tank lines, regardless of the vapor test results in the rooms or areas where the lines are located.
4. Areas such as roofs with vents, flame arrestors or exhausts originating from whiskey/alcohol processing and/or storage areas.
5. The grain processing areas, as well as, equipment, bins, and conveyors used to process, handle, transport or store grain.
6. Locations where flammable liquids (other than alcohol) are stored, processed or used. Examples include but are not limited to gasoline and other fuels, paint, oil, flammable insecticides and pesticides, and flammable cleaning liquids and solvents.
7. Containers (drums, tanks, barrels, etc.) that either do or have contained flammable and/or toxic liquids.
8. Battery charging stations.

The following should be considered to minimize the risk associated with Hot Work in Hazardous Areas:

1. Properly trained Fire Watch Personnel should be maintained throughout the operation and for at least thirty (30) minutes after the Hot Work is completed.
2. When possible, bring work to a safe area and minimize hot work in the hazardous space. Bringing it near to an open exterior door is desirable.
3. Close all interior doors, tank hatches and any open product containers.
4. Open all exterior doors for ventilation.
5. Turn on all ventilation systems.
6. Have fire extinguishers, blankets and related equipment handy; know where fire hoses are located.
7. There shall be no processing or product transfers in the area.
8. If existing alcohol product piping is to be welded or soldered, it shall be positively shut off and locked out, drained, blown or rinsed clear of all vapors with compressed air and dams inserted upstream of potential flow to assure a clean pipe free of alcohol or alcohol vapors.

Appendix F
Sample Self-Inspection Form for Fire Prevention

Plant: ____________________

Location: ____________________ **Date:** ____________________

FIRE PREVENTION INSPECTION FORM - Page 1 of 3
(To be made at least once a week)

List ALL Inside and Outside FIRE PROTECTION VALVES. Notify the Insurance Department if ANY valve is left closed.

Valve Number	Controls	Open	Sealed	Shut	Water Pressure	Pressure with Drain Valve Open	Valve Number	Controls	Open	Sealed	Shut	Water Pressure	Pressure with Drain Valve Open

If any valve found shut or unsealed, give explanation on reverse of sheet; replace missing seals and record pressure with drain valve wide open after resealing; if any sprinkler alarms inoperative, comment on corrective action being taken.
Are Dry Pipe Valves on Air?____________ Did you test for water column? ___________ Check low points for condensate? ___________

SPRINKLERS AND PIPING

Defects	Location	What action is being taken?
Stock within 36" (or 18" where allowed) of sprinklers		
Sprinklers or piping bent		
Sprinklers painted		
Sprinklers or piping corroded		
Sprinklers loaded with dirt		
Sprinklers obstructed by new partitions		
New platform, etc. requiring sprinklers		

Was water drained from all low points on dry pipe systems?

FIRE PUMPS

Name of Pump	Type of Pump Drive, Electric, Diesel, Gas Engine	Tested Today?	Water Pressure with Pump Running	Condition of Pump
			lbs.	
			lbs.	
			lbs.	
			lbs.	
			lbs.	

Was pump reservoir found full? ________ If not, did you have it filled? __________ Is pump suction clean? __________
Is pump priming tank full? ________ If electric pump, are contact points on all switches, circuit-breakers, controllers, etc., in good condition? ________ If engine drive pump, is fuel supply adequate? ________ Number Gals. on hand? ________ Is battery charger in operating condition? ________ Is water in battery at proper level? ________ Battery hydrometer reading? ________ If reading was low, was battery promptly replaced or recharged? ________ Any delay in picking up suction? ________

FIRE PREVENTION INSPECTION FORM - Page 2 of 3

PUBLIC WATER SUPPLY

Is public water supply in service? ________ Pressure on gauge? ________ lbs.

WATER TANK - ELEVATED RESERVOIR

Found Full? ________ If not, did you have it filled?________ Is by-pass for filling kept shut? ________ Is level gauge in working in order? ________ Is tank heater in working order? ________ Temperature of water? _________°F If pressure tank, give gauge reading ________ lbs. Is water in pressure tank at 2/3rds level? ________

HOSE HOUSES

Were any obstructed? ________ Were the hydrants drained properly? ________

Hose House No.	No. ft. Hose	No. Noz-zles	No. Axes	No. Bars	No. Lan-terns	No. Span-ners	No. Wrench-es	Arr'gd O.K.	Hose House No.	No. ft. Hose	No. Noz-zles	No. Axes	No. Bars	No. Lan-terns	No. Span-ners	No. Wrench-es	Arr'gd O.K.
1									5								
2									6								
3									7								
4									8								

FIRE DOORS

Were all doors and shutters in good condition and working order? ________ Were automatic closing devices in good order? ________
Comment on all defective doors, shutters, and automatic closing devices and nature of defect.

STANDPIPES AND HOSE

Was hose attached to each outlet? __________ Nozzle attached? __________ Properly racked? __________
Condition? ____

PORTABLE FIRE EXTINGUISHERS

Did you examine each unit? __________ Did you arrange for all necessary refills? __________ Are any exposed to freezing? __________
Were all units accessible and in good condition? __________

HOUSEKEEPING

List locations where housekeeping was not satisfactory: ____
____
Will these be cleaned up? ____

FIRE ALARM TESTING

Alarms tested? ___________________ Comment on any defective alarms. ____

WIRING AND ELECTRICAL EQUIPMENT

Are all panel boards, switch and fuse cabinets clean? ________ Are all outlet box covers in place? ________ Are all cabinet doors latched shut? ________ Are motors clean, externally and internally? ________ Are they properly lubricated? ________ Is there any over fusing of circuits? ____
Is there any temporary wiring? ____________ If so, comment on locations? ____

FIRE PREVENTION INSPECTION FORM - Page 3 of 3

HEATING

Are all steam pipes and coils 1-inch clear of woodwork and supported safely? ____
Are all unit heaters in good operating condition and proper clearances maintained?____________________________________
Are all portable heaters in good operating condition, equipped with safety devices and authorized?_______________________

FLAMMABLE AND COMBUSTIBLE MATERIALS

Were these materials needed where found? __________ Were they safely stored and handled? __________ Were quantities limited to one day's supply inside building in each case? __________ Are safety cans used and in good condition? __________

SMOKING

Is housekeeping satisfactory in permitted areas? ____
Did you find any evidence of smoking in restricted areas? ____

Inspected by: ____ **Date:** ____________________________

Checked by: ____ **Position:** __________________________

Appendix G
Summary of Distilling Industry Fire Losses 1933 – 2004

This data is a compilation of information submitted by various companies.

Summary of Distilling Industry Fire Losses 1933 – 2004

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
1.	Sept. 1/33	Rossville Distillery Lawrenceburg, Indiana	Tank Room	A.S.	Unknown	Unknown	250,000	Unknown	None
2.	April 28/34	James E. Pepper Dist. Company – Lexington, Kentucky	4 Whiskey Warehouses 1 Bottling House	N.S.	Use of gasoline to kindle fire	Considerable but unknown	2,655,000	Probably, but unknown	1 Death
3.	March 16/35	Penn-Maryland Corp. Peoria, Illinois	Rectifying and Bottling Plant	N.S.	Unknown	17 drums alcohol 12,670 gallons whiskey in tanks, 1,038 bbls. of whiskey, 14,160 cases whiskey in bottles	883,000	Yes, but unknown	None
4.	July 22/35	Hiram-Walker & Sons Inc. Peoria, Illinois	Whiskey Warehouse	A.S. (collapse destroyed sprinklers)	Unknown	81,000 barrels	1,850,000	Probably None	None
5.	March 2/38	Old Kennebeck Distillery Frankfort, Kentucky	Mill & Distillery Building and Boiler House	N.S.	Spontaneous Heating of sacked grain	Unknown	150,000 (uninsured)	Probably, but unknown	None
6.	Nov. 12/38	Glenmore Distilleries Co., Inc. Owensboro, Daviess Co., Kentucky	Bottling House	Mostly N.S	Unknown	32,000 barrels + 24,000 gallons	2,000,000	Probably, but unknown	None
7.	1938	Joseph E. Seagram & Sons Inc. Lawrenceburg, Indiana	Tank Room	A.S. (14 heads extinguished fire)	Electrician opened a switch; created a spark	Unknown	Small	Unknown	1 Death
8.	March 19/39	Distillers Corp. Ltd. Ville La Salle, Quebec, Canada	Distillery (fire involved 8,000 imperial gallon doubler)	A.S. (25 heads operated. Fire controlled by sprinklers & hose streams)	Cause unknown, but presumably vapor discharge plus non-explosion-proof electric switch	Unknown but modest	800	Slight, if any	None
9.	May 5/39	Penna, Distilling Co. Logansport, Pennsylvania	Whiskey Warehouse	N.S.	Unknown	10,000 barrels	500,000	Unknown	None
10.	Late 1930's	Four Roses Distilling Co. North Kresson St., Baltimore, Maryland	Whiskey Warehouse	A.S.	Portable steel barrel rack collapsed, spark ignited a small fire; extinguished by personnel with water	None	None	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
11.	Nov. 11/40	Calvert Distilling Co. Relay, Maryland	Mill Building	A.S.	Equipment explosion. Operator dangled heavy explosion-proof light into grain bin, and wiring shorted at fixture.	None	15,000	None	1 injury – severe 2nd degree burns
12.	Feb. 23/43	Hiram Walker & Sons Windsor, Ontario, Canada	Bottling Building	A.S. (6 heads extinguished fire)	Spontaneous ignition in bales of waste paper in basement.	None	Small	Small	None
13.	April 27/43	Hiram Walker & Sons Windsor, Ontario, Canada	Mill Building	A.S. (1 head extinguished fire)	Small explosion in dust vent on 3rd floor. Inspection doors blown open permitting 1 head to extinguish fire.	None	Small	Unknown	None
14.	June 1943	Calvert Distilling Co. Gwynnbrook, Maryland	Bottling Building	A.S. (20 heads operated)	Tail box on still over-flowed and entered a non-explosion proof switch box under tail.	Unknown	Small	Unknown	None
15.	Dec. 15/43	Hiram Walker & Sons Windsor, Ontario, Canada	Grain Dryer	A.S. (1 head extinguished fire)	Foreign material such as a rag or piece of paper on the dryer.	None	400	Small	None
16.	Feb. 2/24	Joseph E. Seagram & Sons, Inc. Lawrenceburg, Indiana	Main Office	A.S. (2 heads controlled fire)	Spontaneous combustion in paint box	None	Small	None	None
17.	March 3/44	Distillers Corp. Ltd. Ville La Salle Quebec, Canada	Forge Shop	N.S.	Welding and cutting operations	None	Small	None	None
18.	June 10/44	Publicker Alcohol Co. Philadelphia, PA	Distillery Building	N.S.	Cutting or welding spark	None	48, 700	Unknown	None
19.	June 1/45	Barton Distilling Co. Bardstown, Kentucky	Distillery Building	N.S.	Defective alcohol pump	Unknown	171,000	Probably, but unknown	None

Comment 32C

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
20.	July 11/46	Schenley-Coronet Distillery Rippon, California	Distillery Building Brandy Storage Building	A.S. (Explosion partially destroy-ed system. After gravity tank supply was exhausted, the fire department did not pump into sprinkler system).	Alcohol fumes ignited by fire in boiler room	20,000 gallons of brandy	680,000	None	None
21.	Sept. 18/46	Hiram Walker & Sons Ltd. Windsor, Ontario, Canada	Bonded Tank House	A.S. (32 heads operated. Fire controlled sprinklers and hose lines.)	Employees replacing pump opened alcohol line under pressure. Alcohol sprayed on lamp, breaking it, causing ignition	Small	Small	None	None
22.	Dec. 16/46	Pebbleford Distilling Co. Wilders, Kentucky	Bottling House & Cased Goods	N.S.	Hot plate left on in Government office	20,000 gallons	482,000	Minor	None
23.	June 13/47	Distillers Corp. Ville La Salle Quebec, Canada	Grain Dryer Building	A.S. (5 heads controlled fire)	Cutting welding spark	None	10,000	None	None
24.	Dec. 24/47	Distillers Corp. Ville La Salle Quebec, Canada	Grain Dryer Building	A.S.	Ignition of residue from the dried grain mash adhering to the interior of the blower duct	None	10,000	Minor	None
25.	Feb. 20/48	Ozark Mountain Distilling Co. Joplin, Missouri	Bottling Plant	N.S.	Unknown	Considerable but unknown	116,000	Probably, but unknown	None
26.	June 16/48	Schenley Distillers San Francisco, California	Bottling & Receiving	A.S.	Welding Torch	Unknown	Small	None	None
27.	Sept. 13/49	Hiram Walker & Sons Inc. Peoria, Illinois	Distillery	A.S.	Vapor explosion	Unknown	400,000	300,000	2 Deaths
28.	Sept. 14/49	Foster Trading Co. (T.W. Samuels Dist.) Deatsville, Nelson Co. Kentucky	Whiskey Warehouse	N.S.	Unknown (possibly painters)	10,273 barrels	600,000	Probably none	None

Comment 32C

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
29.	Oct. 20/49	Kentucky River Dist. Inc. Camp Nelson, Jessamine Co., Kentucky	Whiskey Warehouse	N.S.	Unknown	17,945 barrels	1,400,000	Probably none	None
30.	1949	South Queensferry near Edinburgh, Scotland	Bond	N.S.	No information	Unknown	1,400,000	Unknown	Unknown
31.	March 13/50	Calvert Distilling Co. Relay, Maryland	Mill Building	A.S. (23 heads operated)	Metal bucket on conveyor rubbed against side of grain elevator. Spark caused explosion.	None	15,000	Unknown	None
32.	Aug. 15/50	Calvert Distillers (Canada) Ltd.; Amherstburg, Ontario Canada	Still Building	A.S. (damaged by explosion)	Vapor explosion unknown	19,500 gallons	754,000	109,400 (extra expense)	None
33.	1951	57 N. Canal Bank St. Glasgow, Scotland	Bond	N.S.	No Information	Unknown	3,780	Unknown	Unknown
34.	Aug. 27/51	Hiram Walker Windsor, Ontario, Canada	Grain Fire	A.S. (37 heads extinguished fire)	Unknown	None	200	Probably none	None
35.	Dec. 14/51	Joseph E. Seagram & Sons Inc. Lawrenceburg, Indiana	Control Lab	A.S. (CO_2 extinguishers put out fire)	Oil vapors from test being performed ignited	None	Small	Small	None
36.	1952	Logavulin Distillery Port Ellen, Islay, Argyllshire, Scotland	Malt Mill	N.S.	No Information	Unknown	14,000	Unknown	Unknown
37.	June 21/52	W.C. Hardesty Co. Etobriote, Ontario, Canada	Still House	A.S. (16 heads extinguished fire)	Unknown	Unknown	Moderate	Unknown	None
38.	July 25/52	W. & A Gilby Ltd. New Toronto, Ontario, Canada	Distillery	A.S. (2 heads extinguished fire)	Unknown	Unknown	Moderate	Unknown	None
39.	Feb. 25/53	Thomas Adams Dist. Vancouver, B.C., Canada	Barrel & Glass Shed	N.S.	Unknown	None	65,000	125,000	None
40.	Aug. 4/54	American Distilling Co. Pekin, Illinois	Whiskey Warehouses & Other Buildings	N.S.	Lightning	91,000	7,500,000 barrels	Probably, but unknown	6 Deaths 30 injured
41.	May 6/55	Melcher's Distilleries Ltd. Berthierville, Quebec, Canada	Still Building	A.S.	Vapor explosion cause unknown	Unknown	8,000	Probably, but unknown	Unknown
42.	May 26/55	Publicker Industries Inc. Philadelphia, PA (Bigler St. Distillery)	Still Building	A.S.	Vapor explosion cause unknown	400,000 gallons	700,000		4 Deaths

Summary of Distilling Industry Fire Losses 1933 – 2004

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Loss (Best Data Available) Whiskey Inventory	Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
43.	1955	Quality St. Leith, Scotland	Bond	N.S.	No information	Unknown	910,000	Unknown	Unknown
44.	Jan. 10/57	Hiram Walker Peoria, Illinois	Power House	N.S.	Oil heater exploded	None	10,000	None	None
45.	Feb. 24/57	McCormack Distilling Co. Weston, Missouri	Boiler Room and Distillery	N.S.	Defective Wiring	None	200,000	Unknown	None
46.	June 11/57	Schenley Distillers Inc. Frankfort, KY	Mill Building	A.S.	Foreign body entered attrition mill causing spark and grain dust explosion.	None	500	None	None
47.	June 20/57	Schenley Distillers Inc. Lexington, KY	Distribution circuits to dry house		Lightning	None	1,200	None	None
48.	July 5/57	Hiram Walker Peoria, Illinois	Wash Room (Racks)	N.S.	Unknown	None	Small	None	None
49.	Nov. 11/57	Joseph E. Seagram & Sons Lawrenceburg, Indiana	Maintenance Shop	A.S. (2 heads extinguished fire)	Fusel oil vapors from mash hose ignited	None	Small	None	None
50.	June 16/58	Hiram Walker Peoria, Illinois	Grain elevator trestle	N.S.	Unknown	None	12,000	None	None
51.	Sept. 4/58	Hiram Walker Windsor, Ontario, Canada	Whiskey Warehouse	A.S. (8 heads controlled fire)	Dump-through over-flowed on light fixture below	Unknown	7,750	None	None
52.	Sept. 29/59	Hiram Walker Windsor, Ontario, Canada	Scale & Tank House	A.S. (did not operate)	Lightning strike	Unknown	27,000	Unknown	None
53.	Feb. 27/60	BC Distillery Co. Ltd. New Westminster, B.C. Canada	Dryer House	A.S. (1 head controlled fire)	Dryer over-looked during normal clean up	None	4,500	None	None
54.	March 28/60	Arbuckle Smith & Co. Ltd. Glasgow, Scotland	Whiskey Warehouse	N.S.	Unknown	Very Large	8,400,000	Probably, but unknown	19 Deaths
55.	June 30/60	Renlea Distilleries Inc. (Medley) Owensboro, Daviess Co., Kentucky	Whiskey Warehouse	N.S.	Lightning	20,000 barrels	1,650,000	None	None
56.	1960	Talisker Distilling Co. Carbost, Isle of Skye, Scotland	Still House	N.S.	No information	Unknown	98,000	Unknown	Unknown
57.	Sept. 7/61	Hiram Walker Peoria, Illinois	Cereal Products Building	A.S.	Friction in rotary dryer	None	400	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
58.	Dec. 2/61	Hiram Walker Peoria, Illinois	Cereal Products Building	A.S.	Friction in rotary dryer	None	1,200	None	None
59.	Dec. 29/61	Calvert Distilling Co. Gwynnbrook, Maryland	Bottling Building (idle) Locker Room	A. S. (sprinklers out of service – no heat provided for the building)	Temporary extension cord in locker room used by warehouseman	None	Small	None	None
60.	Feb. 6/62	Joseph E. Seagram & Sons, Ltd. Waterloo, Ontario, Canada	Truck & Still House exterior	A.S. (but fire was exterior)	Faulty Still operation discharging vapors to outside	1,800 imperial gallons	5,000	None	None
61.	May 5/62	Alberta Distillers Ltd. Calgary, Alberta, Canada	Still Building	A.S. (explosion partially damaged sprink-lers. However, sprinkler system operated satis-factorily and contained fire)	Vapor explosion, cause unknown	Unknown	573,000 36,000 stock	300,000	1 Death
62.	May 4/63	American Distilling Co. Sausalito, California	Whiskey Warehouse	N.S.	Unknown, possibly vandals	30,000 barrels	600,000	Unknown	None
63.	1963	10/12 & 26 Oswald Street Glasgow, Scotland	Bond	N.S.	No Information	Unknown	79,800	Unknown	Unknown
64.	July 5/64	Corn Products Paisley, Scotland	Feed House	Unknown	Equipment malfunction. Dust explosion – no fire.	None	Building destroyed. No figures.		5 deaths
65.	July 29/64	Melcher's Distillers Ltd. Berthierville, Quebec, Canada	Two Bonded Alcohol Tank Warehouses	A.S. (In Building 107 six sprinklers con-trolled tank fire. In Building 202, explosion disrupted sprinklers)	Lightning strike. Apparent vapor explosions in tanks vented indoors.	Unknown	50,000	Unknown	Unknown
66.	July 19/66	Associated Kentucky Distillers Co. Ekron, Kentucky	Warehouse	N.S.	Lightning	None	300		None
67.	Nov. 7/66	Old Boone Distillery Co. Meadowlawn, Kentucky	Bottling and miscellaneous storage buildings	N.S.	Cause undetermined	Large quantity of whiskey (no figure)	4 buildings (no figure)		None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
68.	April 25/68	Grosscurth Distillery Louisville, Kentucky	Two Warehouses	N.S.	Explosion/fire cause undetermined	4,855	Excess of 500,000		None
69.	June 26/68	Calvert Distilling Co. Relay, Maryland	Distillery building	A.S. (not a factor)	Vapors ignited in elevator penthouse	None	5,000	None	None
70.	July 4/68	Waterfill & Frazier Distillery Co., Inc. Bardstown, Kentucky	Warehouse	N.S.	Unknown	Approximately 7,000 barrels	500,000		None
71.	Sept. 27/68	Carthage Distillery Cincinnati, Ohio	Warehouse	A.S. (3 heads extinguished fire)	Either hoop spark or electric spark ignited barrel spill	1 barrel	Small		6 burned
72.	May 20/69	Four Roses Distilling Co. Kresson St., Baltimore, MD	Grain Dryer	A.S. (controlled by hand extinguisher)	Friction	None	None	None	None
73.	Aug. 11/69	Hiram Walker & Sons, Inc. Peoria, Illinois	Warehouse	A.S. (no heads operated)	Lightning	None	800	None	None
74.	Oct. 2/69	Old Crow Distillery Frankfort, Kentucky	Bottling House	A.S. (16 heads extinguished fire)	Unknown, possibly smoking	None	800	None	None
75.	Oct. 29/69	Virgin Island Rum Ind. St. Croix, Virgin Islands	Cistern Tank Building & Barrel Warehouse	N.S.	Electrical	3,000 gallons rum	36,000		None
76.	Sept. 18/70	Bacardi Distillers Nassau, Bahamas	Bottling Building	N.S.	Electrical	100,000 gallons rum	1,500,000		None
77.	Jan. 18/71	Old Boone Distillery Co. Meadowlawn, KY	Distillery, Boiler Room, Storage & Maintenance	N.S.	Unknown	Not available	1,000,000		None
78.	Feb. 24/ 71	Publicker Industries Philadelphia, PA	Storage Tank	N.S.	Unknown	50,000 gallons alcohol	750,000		None
79.	April 22/71	Cia-Ron Carioca San Juan, Puerto Rico	Still Building and Tank Rooms	N.S.	Probably electrical	6,000 gallons rum	50,000		None
80.	May 17/71	Hiram Walker & Sons Ltd. Walkerville, Ontario, Canada	Barrel Filling	A.S. (controlled by hand extinguishers)	Electrical	1 barrel	Small	None	None
81.	May 1971	Distillers Corp. Ltd. Stellenbosch, S.A.	Distillery Tank Room	N.S.	Welding	Limited	10,000	None	None
82.	June 30/71	The Fleischman Distilling Corp. Owensboro, Kentucky	Still House	N.S.	Welding	None	4,200	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Loss (Best Data Available) Whiskey Inventory	Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
83.	Sept. 8/71	Calvert Distilling Co. Relay, Maryland	Rectifying Building (one tank)	A.S. (no heads operated)	Static Electricity-flash fire at vapor space	None	Small	None	None
84.	Sept. 24/71	Old Crow Distillery Frankfort, Kentucky	Bottling House	A.S. (not a factor as fire was exterior to building)	Electrical – defective switch on whiskey chiller	None	2,900	None	None
85.	Jan. 20/72	Thomas Adams Distillers Ltd. Marpole, B.C. Canada	Rail Car Unloading and Tank Building	A.S. (50 heads operated due to heat entering stair shaft)	Improper electric pump under dock & leak in hose	None	500	None	None
86.	Feb. 19/72	Joseph E. Seagram & Sons Inc. Athertonville, Kentucky	Mill & Still Building	N.S.	Unknown, probably foreign matter in grain pulverizer	None	520,000	None	None
87.	Oct. 13/72	Puerto Rico Distillers, Inc. Arecibo, Puerto Rico	Tank Room	N.S.	Lightning	17,000 gallons high-proof spirits	78,000	None	None
88.	Oct. 22/73	Joseph E. Seagram & Sons Inc. Amherstburg, Ontario, Canada	Tank Room	A.S.	Tank overflow & smoking	130 gallons	Under 500	None	None
89.	Feb. 1974	Distillers Corp. Ltd. Worcester, S.A.	External Spirit Storage Tanks	N.S.	Welding	Large stocks of feints	325,000	Minor	One
90.	June 18/74	Chivas Bros. Ltd. Dalmuir, Scotland	Tank Room	N.S.	Unauthorized	15 gallons	1,000	None	None
91.	Sept. 6/74	Martell Warehouse Cognac, France	Warehouse	N.S.	Barrel spilled on fork struck	1,331,000 gallons	11,000,000	None	None
92.	July 10/75	Long John Distillers	Whisky Warehouse	N.S.	Willful fire raising	Vary Large	Unknown	Unknown	None
93.	July 10/75	West Thorn Dist. Glasgow, Scotland	Warehouse	N.S.	Unknown ignition in empty barrel pile adjoining warehouse	450,000 120 proof	2,000,000	None	None
94.	Dec. 3/75	Alberta Distillers Ltd. Calgary, Alberta	Beer Still	A.S.	Welding	None	510,000	Some included in direct loss	1 minor injury
95.	March 1976	Distillers Corp. Ltd. Robertson, S.A.	Distillery Tank Room	N.S.	Welding	Limited	3,176	None	None
96.	July 15/76	Brown-Forman Distillers Corp.; Louisville, Kentucky	Cooling Tower	Disconnected	Cutting & Welding	None	43,000	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
97.	Oct. 1976	Niori Distillery Dobrado, San Paolo, Brazil	Tank Room	N.S.	Unknown	500,000 gallons	Unknown	Unknown	Several injuries
98.	June 29/78	Seagram Company Ltd. Ville La Salle, Quebec, Canada	Tank Room Roof	A.S.	Gas fired asphalt truck	400-500 gallons	Unknown	None	None
99.	March 20/79	American Distillers Inc. Pekin, Illinois	Tank Room, Bottling Room	N.S.	Overflow of tank and electrical short	Unknown	5,000,000	Considerable	None
100.	April 18/79	Joseph E. Seagram & Sons Inc. Williamson, PA	Warehouse	A.S.	Unapproved portable electrics	1 Barrel	5,523	None	None
101.	July 22/79	Joseph S. Finch & Co. Schenley, PA	Warehouse	A.S.	Lightning	Unknown	5,000	None	None
102.	Dec. 2/77	Irish Distillers Group Northern Ireland	Bonded Warehouse	N.S.	Incendiary	Cased Goods	159,695	None	None
103.	Dec. 1/78	Kilmarnock Strathclyde	Distillery	A.S.	Smoking Cardboard boxes and pallets	Unknown	11,000£	Unknown	None
104.	Dec. 16/78	Joseph E. Seagram & Sons Inc. Relay, MD	Boiler	N.S.	Combustion Control	None	26,245	None	None
105.	July 11/79	Dundee, Tayside	Whiskey Warehouse	N.S.	Careless disposal of smoking materials ignited whiskey impregnated cardboard packaging material.	6,825 liters	300,000£	Unknown	None
106.	July 25/79	Schenley Industries Schenley, Pennsylvania	Whiskey Warehouse	A.S.	Lightning	None	5,000	Unknown	None
107.	Sept. 23/79	Hiram Walker Hillsboro Glass Co.; Hillsboro, IL	Warehouse	3 A.S.	Incendiary	Glassware & Pallets	12,894	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
108.	Sept. 4/80	James B. Beam Distilling Co. Clermont, Kentucky	52,000 gallon, 28' x 15' outside storage tank completely topped off with 190° alcohol. Tank was vented, diked & grounded. No lightning rod. 15 ft. from other similar tanks.	N.S.	Tank was struck by lightning. Small explosion of vapor but no fire. Tank puffed out. Two holes in tank point where ladder was welded inside tank. Whiskey escaped. Company personnel diluted whiskey with fire hoses. Presence of welded ladder caused rupture of tank.	52,000 gallons of 190° proof	62,363	14,117	None
109.	Jan. 5/81	Joseph E. Seagram & Sons, Inc. Dundalk, Maryland	Air compressor motor	A.S.	Insulation broke down on motor windings	None	5,740	None	None
110.	Jan. 1981	Distillers Corp. Ltd. Stellenbosch, S.A.	Distillery Tank Room	N.S.	Electrical fault on portable pump	Unknown	67,240	None	None
111.	March 3/81	Heublein Spirits Group Allen Park, MI	Rectifying Department	A.S.	Alcohol spill on soldering	None	Less than 20,000	None	None 2 injured
112.	March 21/81	Joseph E. Seagram & Sons, Inc. Relay, Maryland	Boiler	N.S.	Combustion controls	None	54,968	None	None
113.	April 7/81	Hiram Walker Hillsboro Glass Co. Vandalia, IL	Distribution Warehouse	N.S.	Unknown	Glassware	105,400	None	None
114.	June 17/81	Joseph E. Seagram & Sons, Inc. Relay, Maryland	Boiler	N.S.	Unknown	None	5,984	None	None
115.	Nov. 13/81	Irish Distillers Group Ferrybank, Waterford	Cased goods stored in open	N.S.	Unknown	Pallets, empty bottles	15,572	None	None
116.	Dec. 12/81	The Black Prince Distillery Clifton, New Jersey	Heating equipment	A.S.	Unknown	None	9,800	None	None
117.	March 5/82	Gooderham & Worts Ltd. Toronto, Ontario	Rackhouse D – Fire Damage to Roofing and Flashing	N.A.	Exposure fire	Nil	1,377	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Loss (Best Data Available) Whiskey Inventory	Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
118.	May 9/82	Joseph E. Seagram & Sons, Inc. Memphis, TN (Cooperage)	Lift Truck	A.S.	Electrical short in lift truck wiring	None	2,929	None	None
119.	May 11/82	Scotland	Mill Building	Unknown	Dust explosion	Unknown	Unknown	Unknown	None
120.	May 22/82	Hiram Walker & Sons (Scotland) PLC Dumbarton, Scotland	Timber pallets stacked in yard	N.A.	Incendiary	Pallets	5,095	None	None
121.	Sept. 1982	Joseph E. Seagram & Sons, Inc. Glen Grant Dist. Scotland	Grain Elevator	N.S.	Static	Grain	5,000	None	None
122.	Feb. 16/83	Joseph E. Seagram & Sons Ltd. La Salle, Quebec	Boiler	N.A.	Improper fuel train arrangement and operation	Nil	150,000	None	None
123.	July 30/84	Newcastle-upon-Tyne Tyne & Wear		Unknown	Unknown	Unknown	86£	Unknown	Unknown
124.	Aug. 12/84	East Keswick Leeds, West Yorkshire		Unknown	Heat	Unknown	74,000£	Unknown	Unknown
125.	Nov. 29/84	Gonzalez Byass	Bottling & Warehousing Complex	N.S.	Short circuit	11 million liters of brandy	4,000 million pesetas	Unknown	None
126.	Jan. 31/85	Jamestown Highlands & Islands		Unknown	Deliberate ignition	Unknown	50,000£	Unknown	Unknown
127.	March 4/85	Isleworth London		Unknown	Deliberate	Unknown ignition	2,000,000£	Unknown	Unknown
128.	April 26/85	Wolverhampton West Midlands		Unknown	Unknown	Unknown	150,000£	Unknown	Unknown
129.	1985		Rotary Drier	Manual Steam	Hot heating tube	None	10,000	None	None
130.	May 4/86	Newton le Willows Merseyside		Unknown	Unknown	Unknown	93,000£	Unknown	Unknown
131.	July 31/86	Edinburgh Lothian & Borders		Unknown	Electric wiring	Unknown	60,000£	Unknown	Unknown
132.	Aug. 10/86	North Ashton Ashton in Makerfield Greater Manchester		Unknown	Deliberate ignition	Unknown	150,000£	Unknown	Unknown
133.	Dec. 14/86	Edinburgh Lothian & Borders		Unknown	Deliberate ignition	Unknown	325,000£	Unknown	Unknown

Comment 32C

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
134.	Dec. 23/86	Haddington Lothian & Borders		Unknown	Sparks	Unknown	260,000£	Unknown	Unknown
135.	May 27/87	Middleton Greater Manchester		Unknown	Deliberate ignition	Unknown	50,000£	Unknown	Unknown
136.	Aug. 25/87	Stanstead Abbots Nr. Ware; Hertfordshire		Unknown	Electric	Unknown	250,000£	Unknown	Unknown
137.	March 3/88	Kilmarnock Strathclyde		Unknown	Unknown	Unknown	1,500,000£	Unknown	Unknown
138.	Aug. 9/88	Bury St. Edmunds Suffolk		Unknown	Unknown	Unknown	100,000£	Unknown	Unknown
139.	Oct. 30/88	Port Ellen Islay, Strathclyde		Unknown	Oil	Unknown	112,000£	Unknown	Unknown
140.	Nov. 3/88	Glasgow Strathclyde		Unknown	Deliberate ignition	Unknown	85,000£	Unknown	Unknown
141	April 8/89	Pekin Energy Co. Pekin, IL (Aventine Renewable Energy, Inc.)	Distillation Area	N.S.	Pum seal /bearing failure	unknown	$750,000	Unknown	None
142	May 3/89	Kilmarnock Strathclyde	Dry Goods Store	A.S.	Discarded cigarette	Unknown	1,500,000£	Unknown	Unknown
143	1990	Pernod Ricard USA Seagram Lawrenceburg Distillery Lawrenceburg, IN USA	Barrel truck dock	N.S.	Hot work	1 barrel	Small		
144	Jul. 24/91	Hiram Walker & Sons Ltd, Windsor, Ontario, Canada	Dry Grain Building	A.S.	Combustion of dry grain		$200,000		None
145	1991	Pernod Ricard USA Seagram Lawrenceburg Distillery Lawrenceburg, IN USA	Tankroom	A.S.	Lighting fixture	Unknown	Small		None
146	Nov. 7/96	Heaven Hill Distilleries, Inc. Bardstown, KY	Distillery, Cistern Room, Seven Barrel Warehouse	N.S.	Unknown	95,000 Barrels	N.A.	N.A.	None
147	1996	Diageo Operations Italy S.P.A. S. Vittoria d' Alba (CN) Italy	Carton loft	N.S.	Unknown	Not available	250,000	Unknown	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Loss (Best Data Available) Whiskey Inventory	Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
148	June 2/97	Loch Lomond Distillery (Vake of Leven)	Whisky Warehouse	N.S.	Smoking in adjacent cafeteria	Very Large	2500 casks of Whisky	Unknown	None
149	Aug. 29/98	Dailuaine Distillery	Dark grains plant		Smoldering product contained within the dryer ductwork produced large volumes of smoke which rapidly filled all working areas above the first level.	None	Unknown	Unknown	None
150	May 1998	Provesta Flavor Hutchinson, MN	Fermenter Plant	Partially	Electrical MCC shorted	100,000 gallons	$50,000	50,000	None
151	1998	UDV –Toronto	Processing	A.S.	Hotwork procedures not followed	NA	50,000	None	None
152	1998	Pernod Ricard USA Seagram Lawrenceburg Distillery Lawrenceburg, IN USA	Distillation Area	A.S.	Hot work	Little	Small		None
153	July 3/99	Burghead Maltings	Kiln						
154	July 31/99	Port Ellen Maltionds	Kiln	A.S.	Unburnt oil was being sprayed onto the brickwork/ fan casing from the burner, when the burner was put onto the low fire the flame improved sufficiently to ignite this oil.	None	Unknown	Unknown	None
155	Jan. 29/00	Glen Ord Maltings	Maltings	N.S.	Smuldering material in No. 3 Kiln	None	None	None	None

Comment 32C

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Loss (Best Data Available) Whiskey Inventory	Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
156	June 7/00	Roseisle Maltings	Maltings	N.S.	Smuldering materials in the pelletising system.	None	None	None	None
157	June 7/00	Auchroisk Distillery Warehousing	Warehouse	A.S.	Vehicle caught fire at warehouse door.	None	None	None	None
158	Aug. 5/00	Glen Ord Maltings	Kiln	N.S.	Burning mlat observed inside kiln	None	None	None	None
159	Sep. 19/00	Port Ellen Maltings	Electrical switch panel	N.S.	Heat from a shorted coil ignited plastic insulation within the solenoid/	None	None	None	None
160	Nov. 29/00	Port Ellen Maltings	Kiln	N.S.	Dried malt culms in the air on plenum ignited during operation of the dryer.	None	None	None	None
161	2000	Austin Nichol & Co., Inc. Wild Turkey Distillery Lawrencburg, KY USA	Barrel Warehouse	N.S.	Unknown	17,950 barrels	Significant		None
162	Jan. 30/01	Benrinnes Distllery	Tanker loading bay	A.S.	Electrical fire on vehicle	None	None	None	None
163	May 9/01	Port Ellen Maltings	Kiln	N.S.	Blinding of the malt bed lead to excessive air on temperatures and subsequent charring of the malt.	None	None	None	None
164	May 31/01	Cambus spirit filing store	Spirit filling store	A.S.	Electrical fire on vehicle in loading bay.	None	None	None	None
165	July 31/01	Dailuaine Distillery	Dark grains plant	N.S.	Burning material in pellet mill	None	None	None	None
166	Sep. 19/01	Port Ellen Maltings	Kiln	N.S.	Burning material at the air fan ignited the malt bed.	None	None	None	None

	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Loss (Best Data Available) Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
167	Nov. 12/01	Port Dundas Distillery	Dark grains drier	N.S.	The drier tripped resulting in the material within the dryer igniting	None	None	None	None
168	June 24/02	Dailuaine Distillery	Malt handling system	N.S.	Dust explosion in the malt elevator system during maintenance using hot work	None	None	None	None
169	June 25/02	Glen Ord Maltings	Kiln	N.S.	Unburnt oil being sprayed onto the brickwork/ fan casing from burner which was subsequently ignited.	None	None	None	None
170	July 2/02	Glen Ord Maltings	Kiln	N.S.	Fire started in malt bed during drying	None	None	None	None
171	July 27/02	Port Ellen Maltings	Kiln	N.S.	Fire started in malt bed during drying	None	None	None	None
172	Aug. 20/02	Port Ellen Maltings	Kiln	N.S.	Fire started in malt bed during drying	None	None	None	None
173	Sept. 01/02	Glen Ellen Maltings	Kiln	N.S.	Fire started in malt bed during drying	None	None	None	None
174	Sept. 6/02	Glen Ellen Maltings	Kiln	N.S.	Fire started in malt bed during drying	None	None	None	None
175	Sept. 8/02	Glen Ellen Maltings	Kiln	N.S.	Power dip caused fan to trip out resulting in a fire in the malt bed.	None	None	None	None
176	Aug.4/03	Jim Beam Brands Co. Bardstown, KY	Whiskey Warehouse	N.S.	Lightning	18,949 barrels (Containing w/ 1.25 mm P.G.)	N.A.	N.A.	None

						Loss (Best Data Available)			
	Date	Company & Location	Building or Equipment Involved	Automatic Sprinklered or Non-Sprinklered	Cause	Whiskey Inventory	Total Direct Loss $	Business Interruption Loss$	Loss of Life or Injuries
177	2004	Pernod Ricard USA Seagram Lawrenceburg Distillery Lawrenceburg, IN USA	Barrel filling	A.S.	Spark	Small pool	10,000		None
178	Feb. 9/04	Dufftown Distillery	Malt handling plant	N.S.	Dust explosion in malt mill	None	None	None	None
179	March 23/04	Auchroisk Distillery	Tanker loading bay	A.S.	Fire in vehicle electrics	None	None	None	None
180	Dec. 28/04	Port Ellen Maltings	Kiln	N.S.	Fire started in malt bed during drying	None	None	None	None

Appendix H
Bibliography

H-1 Referenced and Incorporated Publications

H-1.1 NFPA Codes and Standards

The following are codes, standards, recommended practices, and manuals published by the National Fire Protection Association.

NFPA 10-2002	Standard for Portable Fire Extinguishers
NFPA 11-2002	Standard for Low-. Medium-, and High-Expansion Foam
NFPA 12-2000,	Standard on Carbon Dioxide Extinguishing Systems
NFPA 12A-2004,	Standard on Halon 1301 Fire Extinguishing Systems
NFPA 13-2002	Standard for Installation of Sprinkler Systems
NFPA 14-2003	Standard for Installation of Standpipe and Hose Systems
NFPA 15-2001	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 17-2002	Standard for Dry Chemical Extinguishing Systems
NFPA 20-2003,	Standard for Installation of Stationary Pumps for Fire Protection
NFPA 22-2003,	Standard for Water Tanks for Private Fire Protection
NFPA 24-2002,	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 25-2002	Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems
NFPA 30-2003	Flammable and Combustible Liquids Code
NFPA 31-2001,	Standard for the Installation of Oil-Burning Equipment
NFPA 51B-2003	Standard for Fire Prevention During Welding, Cutting and other Hot Work
NFPA 54-2002,	ANSI Z223.1-2002National Fuel Gas Code
NFPA 58-2004,	Liquefied Petroleum Gas Code
NFPA 61-2002	Standard for the Prevention of Fires and Dust Explosions and Agricultural and Food Processing Facilities
NFPA 68-2002,	Guide for Venting of Deflagrations
NFPA 69-2002	Standard on Explosion Prevention Systems
NFPA 70-2002,	National Electrical Code
NFPA 70B-2002,	Recommended Practice for Electrical Equipment Maintenance
NFPA 72-2002	National Fire Alarm Code
NFPA 77-2000,	Recommended Practice on Static Electricity
NFPA 80-1999	Standard for Fire Doors and Fire Windows
NFPA 80A-2001	Recommended Practice for Protection of Buildings from Exterior Fire Exposures
NFPA 82-2004	Standard on Incinerators and Waste and Linen Handling Systems and Equipment
NFPA 85-2004	Boiler and Combustion Systems Hazards Code
NFPA 90A-2002	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 91-1999	Standard for Exhaust Systems for Air Conveying of Air Vapors, Gases, Materials and Noncombustible Particulate Solids
NFPA 220-1999	Standard on Types of Building Construction
NFPA 230-2003	Standard for Fire Protection of Storage
NFPA 496-2003	Standard for Purged and Pressurized Enclosures for Electrical Equipment
NFPA 505-2002	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance and Operations
NFPA 601-2000	Standard for Security Services in Fire Loss Prevention
NFPA 780-2000	Standard for the Installation of Lightening Protection Systems
NFPA 1143-2003	Standard for Wild Land Fire Management
NFPA 1961-2002	Standard on Fire Hose
NFPA 1962-2003	Standard for the Inspection, Care and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose

H-1.2 General Information

ANSI B9.1-1971	American Safety Code for Mechanical Refrigeration – American National Standards Institute
ANSI B31,	American National Standard Code for Pressure Piping – American National Standards Institute
API Standard 620-1978,	Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks – American Petroleum Institute
ASHRAE 15-63,	Mechanical Refrigeration – American Society of Heating, Refrigeration, and Air Conditioning Engineers
NFPA	Fire Protection Handbook – 19th Edition – National Fire Protection Association
FM Global	Loss Prevention Data Sheets – published by the Factory Mutual Insurance Company
NBFU/AIA	National Board of Fire Underwriters (currently known as the American Insurance Association) Research Report No. 5 – 1956, with amendments
Distilled Spirits Council	Safe Practices Guide for the Distilled Spirits Industry – Prepared for DISCUS by the Risk Management and Insurance Committee and its Technical Subcommittee in November 1973

H-1.3 Test Information

Factory Mutual Bulletin, No. 35-5	"Comparative Rates of Burning of Gasoline, Alcohol, and Whiskey," July 15, 1935
Factory Mutual Laboratories Report No. 10186	"Fire and Explosions Hazard of Whiskey Rack Warehouses," October 18, 1935; revised December 30, 1935
National Board of Fire Underwriters, Inc.	Report on "Water Distributions Tests of Automatic Sprinklers in Rack Whiskey Warehouses," July 15, 1953
Duggan, James J.,	"Bulk Storage of Alcohol," NFPA Quarterly, July 1953
Underwriters Laboratories, Inc.	"Fire Tests in Simulated Rack Whiskey Warehouse Structures," May-December 1955
Burke, G.M., Report	"Fire Test in Rack Warehouse at Melcher's Distilleries, Bartheirville, Quebec, March 15, 1957
Factory Mutual Engineering Division	"Alcohol Spill Fire Test," R.P. N o. – 13532, November 26, 1957, and August 25, 1958
National Board of Fire Underwriters, Inc.	"Fire Tests in Palletized Storage of Whiskey in Barrels," September 1960
Factory Mutual Research Corporation (for Hiram Walker & Sons, Ltd.)	"Sprinkler Protection of Whiskey Storage Ten Barrels High on Steel Racks," Serial No. 15264, December 23, 1963
Joint Effort	"Fire Tests in Open-Rack Whiskey Warehouse," – August 17, 1963 to May 9, 1964, at Schenley Distillers Inc., Warehouse in Owings Mills, Maryland, G.M. Burke, Chairman of Steering Committee
Factory Mutual Research Corporation (for Hiram Walker & Sons, Ltd.)	"Sprinkler Protection on Whiskey Storage Twelve Barrels High on Steel Racks," Serial No. 18306, June 1969
Factory Mutual Research Corporation (for DISCUS)	"Fire Protection Requirements for High Piled Palletized Whiskey Storage," Serial No. 17792, August 1969
Factory Mutual Research Corporation (for DISCUS Property Protection Subcommittee)	"Fire Protection Requirements for Six-Barrel High, Palletized Storage of Distilled Spirits," Serial No. J.I.OC2RG.RR, February 1979
Factory Mutual Research Corporation (for DISCUS Property Protection Subcommittee)	"Fire Protection Requirements for Six-Barrel High, Palletized Storage of Distilled Spirits Phase II," Serial No. J.I.OEORI.RR, March 1980
Factory Mutual Research Corporation (for Hiram-Walker-Gooderham and Worts, Limited)	"The Effect on Sprinkler Protection of Using 'Thin' Pallets for Palletized Barreled Whiskey Storage," Serial No. J.I.OEOR4.RR, November 1979

Appendix I NFPA-FM-GE GAP Cross Reference

I-1 Scope

I-1.1 When protection criteria are not specifically detailed within this DISCUS Guide or where additional assistance is needed, the typical reference documents are the NFPA Codes and Standards unless otherwise noted.

I-1.2 This appendix cross-references the various NFPA Codes and Standards identified within the Guide or Appendix H – Bibliography to corresponding FM Data Sheets, as published by FM Global (Factory Mutual Insurance Company) and/or GE GAP Guidelines (formerly the IRInformation Guidelines), as published by GE Global Asset Protection Services.

I-1.3 This Guide and the NFPA Codes and Standards are considered acceptable levels of protection. An improved level of protection may be requested of a facility or operation to meet insurability criteria or may be mandated by local, regional, state/provincial, and/or federal authorities. These cross-reference resources are intended to provide appropriate information for an improved level of protection

Table I-1
Cross-Reference – NFPA Codes & Standards to FM Data Sheets and GE GAP Guidelines

NFPA CODES & STANDARDS	FM DATA SHEETS	GE GAP GUIDELINES
10 – Portable Fire Extinguishers	4-5 – Portable Extinguishers	13.7.1.1 – Portable Fire Extinguishers
11 – Low-, Medium-, High-Expansion Foam	4-7N – Low Expansion Foam Systems 4-3N – Medium and High Expansion Foam Systems	12.3.2.1 – Low Expansion Foam Systems 12.3.3.1 – Medium and High Expansion Foam Systems
12 – Carbon Dioxide Extinguishing Systems	4-11N – Carbon Dioxide Extinguishing Systems	13.3.1 – Carbon Dioxide Systems
12A – Halon 1301 Fire Extinguishing Systems	4-8N – Halon 1301 Extinguishing Systems	13.4.1.1 – Halon 1301 Systems
13 – Installation of Sprinkler Systems	2-8N – NFPA 13 Standard for Installation of Sprinkler Systems	12.1.1.0 – Sprinkler Systems
14 – Standpipe and Hose Systems	4-4N – Standpipe and Hose Systems	None
15 – Water Spray Fixed Systems for Fire Protection	4-1N – Fixed Water Spray Systems for Fire Protection	None
16 – Foam-Water Sprinkler and Foam-Water Spray Systems	2-8N – NFPA 13 Standard for Installation of Sprinkler Systems	12.3.1.1 – Foam-Water Sprinkler and Foam-Water Spray Systems
17 – Dry Chemical Extinguishing Systems	4-10 – Dry Chemical Systems	13.1.1.1 – Dry Chemical Extinguishing Systems
20 – Installation of Stationary Pumps for Fire Protection	3-7N – Stationary Pumps for Fire Protection	14.2.1 – Stationary Pumps for Fire Protection
22 – Water Tanks for Private Fire Protection	3-2 – Water Tanks for Fire Protection	14.0.1 – Fire Protection Water Supplies
24 – Installation of Private Fire Service Mains and Their Appurtenances	3-10 – Installation and Maintenance of Fire Service Mains and Their Appurtenances	14.5.0.1 – Private Fire Mains
25 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems	2-81 – Fire Safety Inspections and Sprinkler System Maintenance	12.0.2 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
30 – Flammable and Combustible Liquid Code	7-29 – Flammable Liquid Storage in Portable Containers 7-32 – Flammable Liquid Operations 7-88 – Storage Tanks for Flammable and Combustible Liquids	8.1.0 – Flammable and Combustible Liquids
31 – Installation of Oil-Burning Equipment	6-4 – Oil- and Gas-Fired Single-Burner Boilers 6-5 – Oil- or Gas-Fired Multiple Burner Boilers 6-9 – Industrial Ovens and Dryers 6-10 – Process Furnaces	4.0.5 – Installation of Oil-Burning Equipment 4.1.3 – Combustion and Safety Devices for Automatically Fired Boilers 7.1.0.3 – Boiler Fundamentals
51B – Fire Prevention During Welding, Cutting, and Other Hot Work	10-3 – Hot Work Management	1.9.0 – Cutting, Welding and Other Hot Work
54 – National Fuel Gas Code	7-54 – Natural Gas and Gas Piping	4.0.4 – National Fuel Gas Code
58 – Liquefied Petroleum Gas Code	7-55 – Liquefied Petroleum Gas	8.2.0.1 – Liquefied Petroleum Gas Code
61 – Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities	7-75 – Grain Storage and Milling 7-76 – Prevention and Mitigation of Combustible Dust Explosions and Fires	9.3.2.0 – Dust Collection Systems
68 – Venting of Deflagrations	1-44 – Damage-Limiting Construction	None
69 – Explosion Prevention Systems	7-17 – Explosion Protection Systems	13.5.1 – Deflagration Suppression Systems
70 – National Electric Code	5-7 – National Electric Code	GE GAP 5. – Various Sections

NFPA CODES & STANDARDS	FM DATA SHEETS	GE GAP GUIDELINES
70B – Electrical Equipment Maintenance	5-19 – Switchgear and Circuit Breakers 5-20 – Electrical Testing	GE GAP 5. – Various Sections 1.3.1 – Infrared Inspection
72 – National Fire Alarm Code	5-40 – Fire Alarm Systems 5-48 – Automatic Fire Detection	11.1.1.0 – National Fire Alarm Code
77 – Static Electricity	5-8 – Static Electricity	None
80A – Protection of Buildings from Exterior Fire Exposure	1-20 – Protection Against Exterior Fire Exposure	2.0.5 – Protection of Buildings from Exterior Fire Exposure
82 – Incinerators and Waste and Linen Handling Systems and Equipment	None	17.9 – Solid Waste Disposal and Incineration
85 – Boiler and Combustion Systems Hazards Code	6-2 – Pulverized Coal-Fired Boilers 6-6 – Boiler-Furnace Implosions 6-24 – Coal Pulverizers and Pulverizing Systems	4.1.0 – Introduction to Boiler Combustion Codes and Standards 4.1.1 – Boiler and Combustion Systems Hazard Code
86 – Ovens and Furnaces	6-9 – Industrial Ovens and Dryers 6-10 – Process Furnaces	4.2.0 – Ovens and Furnaces
90A – Air-Conditioning and Ventilating Systems	1-45 – Air Conditioning and Ventilating Systems	None
91 – Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids	7-78 – Industrial Exhaust Systems	9.3.2.0 – Dust Collection Systems
101 – Life Safety Code	None	None
220 – Types of Building Construction	1-1 – Firesafe Building Construction and Materials 1-21 – Fire Resistance of Building Assemblies	2.0.6 – Definitions of Types of Construction
221 – Standard for Fire Walls and Fire Barriers	1-19 – Fire Walls, Subdivisions and Draft Curtains 1-23 – Protection of Openings in Fire Subdivisions	2.2.1 – Standard for Fire Walls and Fire Barriers
230 – Fire Protection of Storage	1-20 – Protection Against Exterior Fire Exposure 7-29 – Flammable Liquid Storage in Portable Containers 7-44 – Spacing of Facilities in Outdoor Chemical Plants 7-88 – Storage Tanks for Flammable and Combustible Liquids 8-8 – Distilled Spirits Storage 8-24 – Idle Pallet Storage 9-17 – Protection Against Arson and Other Incendiary Fires 9-19 – Wildfire / Brushfire Exposure	8.1.0 – Flammable and Combustible Liquids 10.1.1 – Fire Protection of Storage 10.3.1 – Outdoor Storage
496 – Purged and Pressurized Enclosures for Electrical Equipment	5-1 – Electrical Equipment in Hazardous (Classified) Locations	5.12.0.1 – Hazardous (Classified) Location Electric Equipment
497 – Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas	5-1 – Electrical Equipment in Hazardous (Classified) Locations	5.12.0.1 – Hazardous (Classified) Location Electric Equipment
505 – Powered Industrial Trucks Including Type	7-39 – Industrial Trucks	None

NFPA CODES & STANDARDS	FM DATA SHEETS	GE GAP GUIDELINES
Designations, Areas of Use, Conversions, Maintenance, and Operations		
601 – Security Services in Fire Loss Prevention	9-1 – Supervision of Property	1.11.0 – Fire Protection and Security Surveillance
654 – Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	7-76 – Prevention and Mitigation of Combustible Dust Explosions and Fires 7-78 – Industrial Exhaust Systems	9.3.2.0 – Dust Collection Systems
780 – Installation of Lightning Protection Systems	5-11 – Lightning and Surge Protection for Electrical Systems	5.2.1 – Lightning Protection 5.2.2 – Surge Protection
1144 – Protection of Life and Property From Wildfire	9-19 – Wildfire / Brushfire Exposure	None
1961 – Fire Hose	3-10 – Installation and Maintenance of Private Fire Service Mains and Their Appurtenances	1.12.0 – Fire Protection Equipment Inspection 12.0.2 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 14.5.0.1 – Private Fire Mains
1962 – Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and Service Testing of Fire Hose	3-10 – Installation and Maintenance of Private Fire Service Mains and Their Appurtenances	1.12.0 – Fire Protection Equipment Inspection 12.0.2 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 14.5.0.1 – Private Fire Mains
None	7-14 – Fire & Explosion Protection for Flammable Liquid, Flammable Gas, & Liquefied Flammable Gas Processing Equipment & Supporting Structures	9.6.2.1 – Distillation of Flammable or Combustible Liquids 13.5.1 – Deflagration Suppression Systems
None	7-74 – Distilleries	9.6.2.1 – Distillation of Flammable or Combustible Liquids 17.23.3.2 – Distilleries
None	8-8 – Distilled Spirits Storage	8.1.0.1 – Barrel Storage of Distilled Spirits

Update Registration Form

Should you desire to be informed of updates to this document, please complete the address form below and return to:

Distilled Spirits Council
of the United States, Inc. (DISCUS)
Suite 400
1250 Eye Street, NW
Washington, DC 20005

Depending on the volume of the updated material, there may be a small service and handling charge.

(For Revisions of DISCUS Fire Protection Guide)

Name: ______________________________

Title: ______________________________

Company: ______________________________

Address: ______________________________

____

Comment 33A

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I
Great Falls, MT 59401
Phone: 406-454-6905 Fax: 406-454-6919

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: Kathleen McMahon

Complete Address: 151 Wedgewood Ln., Whitefish, MT 59937

Comment Subject (please check one)

- ☒ Special Use Permit Application
- ☐ Subdivision
- ☐ Zoning Text and/or Map Amendment
- ☐ Growth Policy
- ☐ Variance
- ☐ Floodplain Regulation Amendment
- ☐ Subdivision Regulation Amendment
- ☐ County Road Abandonment/ Discontinuation of County Street
- ☐ Other (describe): ______

Comment

See Attachments in Regard to Silver Falls Distillery SUP - ZBOA Public hearing scheduled for 2-13-20

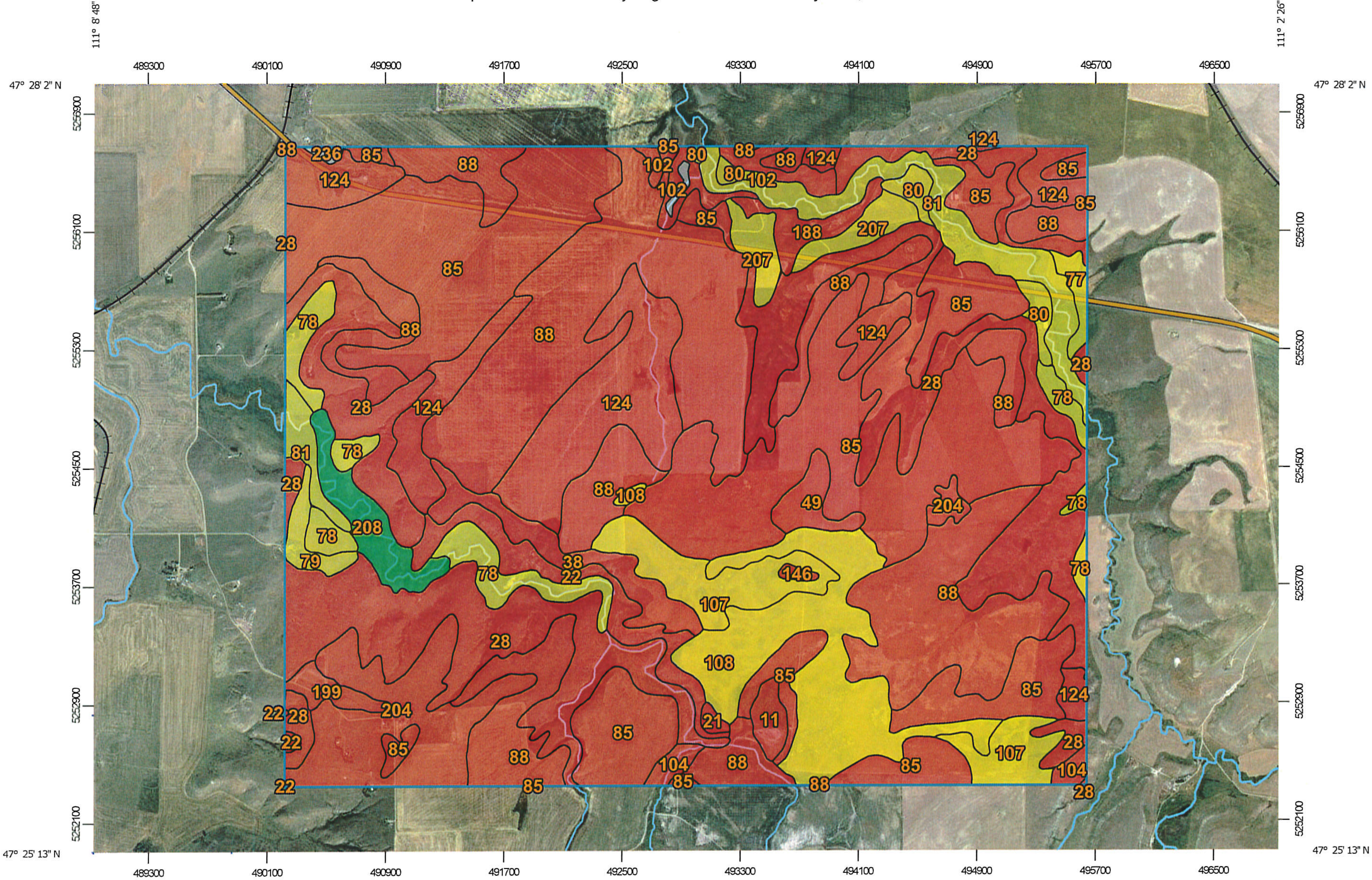
I am a professional land use consultant with over 30 years of experience and a degree in Urban and Regional Planning. I have been hired by Montana's for Responsible Land Use to review the Silver Falls Distillery SUP application. These comments are being submitted on behalf of Montanans For Responsible Land use.

Attached is the NRCS Soil report which indicates that the soils located on the subject property are rated as "Very Limited" for the purpose of disposal of wastewater by irrigation. This poses a risk of both groundwater sources and nearby surface water in streams. (Antelope Creek, Sand Coulee Creek, and Box Elder Creek)

MRFLU request that the public hearing be continued in order for the applicant to submit more information regarding this issue.

For Office Use Only					
Date Received:		Date Reviewed:		Complete:	☐ Yes ☐ No

Disposal of Wastewater by Irrigation—Cascade County Area, Montana



Map Scale: 1:36,600 if printed on A landscape (11" x 8.5") sheet.

N

0 500 1000 2000 3000 Meters

0 1500 3000 6000 9000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Lines

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Points

Very limited

Somewhat limited

Not limited

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cascade County Area, Montana
Survey Area Data: Version 14, Sep 5, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 9, 2010—Feb 15, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Disposal of Wastewater by Irrigation

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
11	Acel silty clay loam, 0 to 2 percent slopes	Very limited	Acel (90%)	Slow water movement (1.00)	23.9	0.4%
			Nishon (6%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Slow water movement (1.00)		
			Gerdrum (1%)	Sodium content (1.00)		
				Slow water movement (0.37)		
21	Big Timber-Castner complex, 8 to 30 percent slopes	Very limited	Big Timber (55%)	Droughty (1.00)	6.3	0.1%
				Too steep for surface application (1.00)		
				Depth to bedrock (1.00)		
				Too steep for sprinkler application (1.00)		
				Slow water movement (0.22)		
			Castner (30%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Depth to bedrock (1.00)		
				Too steep for sprinkler application (1.00)		
			Darret (8%)	Too steep for surface application (1.00)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Slow water movement (1.00)		
				Too steep for sprinkler application (0.98)		
				Depth to bedrock (0.65)		
				Droughty (0.40)		
			Timberg (7%)	Too steep for surface application (1.00)		
				Slow water movement (1.00)		
				Too steep for sprinkler application (0.78)		
				Depth to bedrock (0.10)		
				Droughty (0.04)		
22	Big Timber-Castner complex, 30 to 70 percent slopes	Very limited	Big Timber (55%)	Droughty (1.00)	93.7	1.6%
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to bedrock (1.00)		
				Slow water movement (0.22)		
			Castner (25%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to bedrock (1.00)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Roy (5%)	Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Droughty (0.25)		
				Slow water movement (0.22)		
				Cobble content (0.05)		
28	Bitton and Roy soils, 10 to 65 percent slopes	Very limited	Bitton (45%)	Too steep for surface application (1.00)	989.3	17.0%
				Too steep for sprinkler application (1.00)		
				Cobble content (0.75)		
			Roy (45%)	Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Droughty (0.25)		
				Slow water movement (0.22)		
				Cobble content (0.05)		
			Castner (5%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to bedrock (1.00)		
			Sinnigam (5%)	Droughty (1.00)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Depth to bedrock (1.00)		
				Too steep for surface application (1.00)		
				Cobble content (0.75)		
				Too steep for sprinkler application (0.22)		
38	Castner-Sinnigam complex, 2 to 15 percent slopes	Very limited	Castner (65%)	Droughty (1.00)	86.8	1.5%
				Depth to bedrock (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (0.22)		
			Sinnigam (15%)	Droughty (1.00)		
				Depth to bedrock (1.00)		
				Too steep for surface application (1.00)		
				Cobble content (0.75)		
				Too steep for sprinkler application (0.22)		
			Roy (7%)	Too steep for surface application (1.00)		
				Droughty (0.25)		
				Slow water movement (0.22)		
				Too steep for sprinkler application (0.10)		
				Cobble content (0.05)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Reeder (6%)	Too steep for surface application (1.00)		
				Depth to bedrock (0.71)		
				Droughty (0.47)		
				Too steep for sprinkler application (0.40)		
49	Darret-Castner complex, 2 to 8 percent slopes	Very limited	Darret (60%)	Slow water movement (1.00)	38.0	0.7%
				Depth to bedrock (0.65)		
				Droughty (0.40)		
				Too steep for surface application (0.32)		
			Castner (25%)	Droughty (1.00)		
				Depth to bedrock (1.00)		
				Too steep for surface application (0.32)		
			Big Timber (8%)	Droughty (1.00)		
				Depth to bedrock (1.00)		
				Slow water movement (0.22)		
				Too steep for surface application (0.08)		
			Sinnigam (7%)	Droughty (1.00)		
				Depth to bedrock (1.00)		
				Cobble content (0.75)		
				Slow water movement (0.22)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Too steep for surface application (0.08)		
77	Farnuf loam, 4 to 8 percent slopes	Somewhat limited	Farnuf (90%)	Too steep for surface application (0.68)	19.7	0.3%
			Fairfield (5%)	Too steep for surface application (0.68)		
				Slow water movement (0.22)		
			Work (5%)	Too steep for surface application (0.68)		
				Slow water movement (0.22)		
78	Fergus clay loam, 2 to 4 percent slopes	Somewhat limited	Fergus (90%)	Slow water movement (0.22)	151.6	2.6%
			Twin Creek (10%)	Too steep for surface application (0.32)		
79	Fergus clay loam, 4 to 8 percent slopes	Somewhat limited	Fergus (90%)	Too steep for surface application (0.68)	28.2	0.5%
				Slow water movement (0.22)		
			Twin Creek (5%)	Too steep for surface application (0.32)		
80	Fergus silty clay loam, 0 to 2 percent slopes	Somewhat limited	Fergus (90%)	Slow water movement (0.22)	43.0	0.7%
81	Fergus-Absher silty clay loams, 0 to 2 percent slopes	Somewhat limited	Fergus (70%)	Slow water movement (0.22)	182.2	3.1%
85	Gerber silty clay loam, 0 to 4 percent slopes	Very limited	Gerber (90%)	Slow water movement (1.00)	1,378.5	23.7%

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Acel (4%)	Slow water movement (1.00)		
			Abor (3%)	Slow water movement (1.00)		
				Depth to bedrock (0.46)		
				Droughty (0.42)		
			Lawther (3%)	Slow water movement (1.00)		
88	Gerber-Lawther silty clays, 4 to 8 percent slopes	Very limited	Gerber (55%)	Slow water movement (1.00)	1,298.7	22.3%
				Too steep for surface application (0.68)		
			Lawther (35%)	Slow water movement (1.00)		
				Too steep for surface application (0.68)		
			Acel (10%)	Slow water movement (1.00)		
				Too steep for surface application (0.32)		
102	Hillon clay loam, 15 to 60 percent slopes	Very limited	Hillon (80%)	Too steep for surface application (1.00)	54.1	0.9%
				Too steep for sprinkler application (1.00)		
				Slow water movement (1.00)		
			Hillon, gravelly surface (8%)	Too steep for surface application (1.00)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Too steep for sprinkler application (0.40)		
				Slow water movement (0.37)		
			Kevin (5%)	Too steep for surface application (1.00)		
				Slow water movement (1.00)		
				Too steep for sprinkler application (1.00)		
			Sunburst (2%)	Too steep for surface application (1.00)		
				Slow water movement (1.00)		
				Too steep for sprinkler application (1.00)		
			Neldore (2%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to bedrock (1.00)		
				Slow water movement (1.00)		
			Richey (2%)	Slow water movement (1.00)		
				Too steep for surface application (0.32)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Cabbart (1%)	Too steep for surface application (1.00)		
				Too steep for sprinkler application (1.00)		
				Depth to bedrock (1.00)		
				Droughty (0.99)		
104	Ipano-Castner complex, 8 to 15 percent slopes	Very limited	Ipano (50%)	Too steep for surface application (1.00)	24.6	0.4%
				Too steep for sprinkler application (0.78)		
				Depth to bedrock (0.16)		
				Droughty (0.00)		
			Castner (35%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Depth to bedrock (1.00)		
				Too steep for sprinkler application (0.78)		
			Big Timber (8%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Depth to bedrock (1.00)		
				Too steep for sprinkler application (0.78)		
				Slow water movement (0.22)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Darret (7%)	Too steep for surface application (1.00)		
				Slow water movement (1.00)		
				Too steep for sprinkler application (0.98)		
				Depth to bedrock (0.65)		
				Droughty (0.40)		
107	Ipano-Ticell loams, 0 to 4 percent slopes	Somewhat limited	Ipano (55%)	Depth to bedrock (0.16)	169.8	2.9%
				Droughty (0.00)		
			Absarokee (8%)	Slow water movement (0.22)		
				Depth to bedrock (0.07)		
				Droughty (0.06)		
			Work (7%)	Slow water movement (0.22)		
108	Ipano-Ticell loams, 4 to 10 percent slopes	Somewhat limited	Ipano (55%)	Too steep for surface application (0.92)	317.7	5.5%
				Depth to bedrock (0.16)		
				Too steep for sprinkler application (0.03)		
				Droughty (0.00)		
			Absarokee (8%)	Too steep for surface application (0.32)		
				Slow water movement (0.22)		
				Depth to bedrock (0.07)		
				Droughty (0.06)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Work (7%)	Too steep for surface application (0.68)		
				Slow water movement (0.22)		
124	Lawther-Gerber complex, 8 to 15 percent slopes	Very limited	Lawther (65%)	Too steep for surface application (1.00)	451.7	7.8%
				Slow water movement (1.00)		
				Too steep for sprinkler application (0.78)		
			Gerber (25%)	Too steep for surface application (1.00)		
				Slow water movement (1.00)		
				Too steep for sprinkler application (0.78)		
			Hillon (10%)	Too steep for surface application (1.00)		
				Slow water movement (1.00)		
				Too steep for sprinkler application (0.78)		
146	McKenzie silty clay loam	Very limited	McKenzie (90%)	Slow water movement (1.00)	5.0	0.1%
				Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Salinity (0.13)		
			Acel (10%)	Slow water movement (1.00)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
188	Tally fine sandy loam, 8 to 15 percent slopes	Very limited	Tally (90%)	Filtering capacity (1.00)	40.3	0.7%
				Too steep for surface application (1.00)		
				Too steep for sprinkler application (0.78)		
			Castner (10%)	Droughty (1.00)		
				Too steep for surface application (1.00)		
				Depth to bedrock (1.00)		
				Too steep for sprinkler application (0.98)		
199	Ticell-Castner complex, 0 to 4 percent slopes	Very limited	Ticell (45%)	Droughty (1.00)	26.0	0.4%
				Depth to bedrock (1.00)		
			Castner (30%)	Droughty (1.00)		
				Depth to bedrock (1.00)		
204	Timberg-Castner complex, 2 to 10 percent slopes	Very limited	Timberg (60%)	Slow water movement (1.00)	234.4	4.0%
				Too steep for surface application (0.68)		
				Depth to bedrock (0.10)		
				Droughty (0.04)		
			Castner (20%)	Droughty (1.00)		
				Depth to bedrock (1.00)		
				Too steep for surface application (0.68)		
			Ticell (5%)	Droughty (1.00)		
				Depth to bedrock (1.00)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Too steep for surface application (0.92)		
				Too steep for sprinkler application (0.03)		
			Darret (5%)	Slow water movement (1.00)		
				Depth to bedrock (0.65)		
				Droughty (0.40)		
				Too steep for surface application (0.32)		
207	Twin Creek loam, 2 to 8 percent slopes	Somewhat limited	Twin Creek (90%)	Too steep for surface application (0.32)	72.0	1.2%
			Fergus (3%)	Slow water movement (0.22)		
208	Twin Creek silty clay loam, 0 to 2 percent slopes	Not limited	Twin Creek (90%)		74.6	1.3%
			Straw (4%)			
236	Gravel pits	Not rated	Gravel pits (100%)		4.9	0.1%
237	Water	Not rated	Water (100%)		4.8	0.1%
Totals for Area of Interest					**5,819.7**	**100.0%**

Rating	Acres in AOI	Percent of AOI
Very limited	4,751.3	81.6%
Somewhat limited	984.1	16.9%
Not limited	74.6	1.3%
Null or Not Rated	9.7	0.2%
Totals for Area of Interest	**5,819.7**	**100.0%**

Description

Wastewater includes municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. The effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, saturated hydraulic conductivity (Ksat), slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I Great Falls, MT 59401
Phone: 406-454-6905 | Fax: 406-454-6919
Email: planningcomments@cascadecountymt.gov

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: Carolyn K. Craven

Complete Address: 101 14th Avenue South, Great Falls MT 59405

Comment Subject (please check one):

- ☒ Special Use Permit Application
- ☐ Subdivision
- ☐ Zoning Text and/or Map Amendment
- ☐ Growth Policy
- ☐ Variance
- ☐ Floodplain Regulation Amendment
- ☐ Subdivision Regulation Amendment
- ☐ County Road Abandonment/ Discontinuation of County Street
- ☒ Other (describe): Silver Falls Distillery & Bottling Plant SUP

Comment

01.19.20 SFD Background Info & Questions ZBOA
01.22.20 SFD Wastewater ZBOA
01.26.20 SFD Traffic ZBOA
02.05.20 SFD Fire & Emergency Vehicle Access Concerns ZBOA
02.06.20 SFD Traffic Concerns ZBOA
02.07.20 SFD Cumulative BSC-SFD Impact ZBOA
02.10.20 SFD Water ZBOA
02.10.20 SFD Wastewater Addendum ZBOA
02.11.20 SFD Water ZBOA
02.11.20 SFD Distillery Fire Hazards

For Office Use Only					
Date Received:		Date Reviewed:		Complete:	☐ Yes ☐ No

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

February 11, 2020

PUBLIC COMMENTS

MFP SILVER FALLS DISTILLERY & BOTTLING PLANT SUP
DISTILLERY FIRE HAZARDS

- Fire Hazards
    - Fire and explosion are two major hazards in craft distilleries
        - Fire can occur when vapors from ethanol are released due to leaks in tanks, casks, transfer pumps, pipes and flexible hoses
        - A vapor explosion can occur if enough vapors are released in an enclosed space with nearby ignition sources such as a spark from electrical equipment or a gas boiler.
        - Moving flammable liquids (i.e. ethanol) from one container to another can cause static electricity and increase the chance of fire or explosion.
        - Grain dust is a respiratory irritant and a fire and explosion hazard. When fine dust particles catch fire while suspended in the air, known as deflagration, fire can spread quickly and could lead to an explosion.
        - Chemical spills from the chemicals used in cleaning can also cause fires.

QUESTIONS

1) What does MFP plan to do to prevent fire and explosion hazards inside the distillery?

2) Will MFP commit to providing a secondary emergency vehicle access?

Respectfully submitted,

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

Montanans for Responsible Land Use

C.K. Craven
Homeowner

C.K. Craven
Homeowner

Comment 35A

Public Comment Form

Cascade County Public Works Department Planning Division
121 4th St N, Suite 2H-2I Great Falls, MT 59401
Phone: 406-454-6905 | Fax: 406-454-6919
Email: planningcomments@cascadecountymt.gov

Instructions

This form is for providing public comment to the Cascade County Planning Division for review by any one or more of the following review and/or approval boards: Zoning Board of Adjustment (ZBOA), Planning Board, or Board of County Commissioners. Only complete submissions will be included for board review. Please provide the relevant information for each section below. A complete submission provides all of the following: commenter name and address, comment subject, and commentary on the subject issue(s). If additional space is needed for commentary, please attach additional sheets to this form. Completed forms may be submitted in person at the Planning Division office or by email at planningcomments@cascadecountymt.gov.

Commenter Information

Name: Carolyn K. Craven

Complete Address: 101 14th Avenue South, Great Falls MT 59405

Comment Subject (please check one):

- ☒ Special Use Permit Application
- ☐ Subdivision
- ☐ Zoning Text and/or Map Amendment
- ☐ Growth Policy
- ☐ Variance
- ☐ Floodplain Regulation Amendment
- ☐ Subdivision Regulation Amendment
- ☐ County Road Abandonment/ Discontinuation of County Street
- ☒ Other (describe): Silver Falls Distillery & Bottling Plant SUP

Comment

01.19.20 SFD Background Info & Questions ZBOA
01.22.20 SFD Wastewater ZBOA
01.26.20 SFD Traffic ZBOA
02.05.20 SFD Fire & Emergency Vehicle Access Concerns ZBOA
02.06.20 SFD Traffic Concerns ZBOA
02.07.20 SFD Cumulative BSC-SFD Impact ZBOA
02.10.20 SFD Water ZBOA
02.10.20 SFD Wastewater Addendum ZBOA
02.11.20 SFD Water ZBOA
02.11.20 SFD Distillery Fire Hazards ZBOA
02.11.20 SFD Odors-Dust-Noise-Glare ZBOA

For Office Use Only					
Date Received:		Date Reviewed:		Complete:	☐ Yes ☐ No

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

February 11, 2020

PUBLIC COMMENTS

MFP SILVER FALLS DISTILLERY & BOTTLING PLANT SUP
ODORS – DUST – NOISE – GLARE

- MFP/SFD SUP states in the SUP that "…the facility has the potential to create slight noise, night-time lighting, dust and odors; however these are expected to be negligible with the distillery". They add that "proper surfacing of roads and parking areas will minimize dust" and "outdoor lighting will be directed downward to reduce glare". They are silent on mitigation of noise external to the building and mitigation of odors. They also have not committed to type of road surfacing at this time.
    - MFP adds that "The distillery will be located more than one mile from any existing dwelling or agricultural buildings. Possible conflicts are expected to be minimal, but could include additional traffic, visual changes, additional buildings, night-time lighting), and some noise. Yet, MFP's design team will utilize buffering features to help mitigate noise and visual impacts whenever possible.

- **Odors & Fumes**
    - To make alcohol, carbohydrates like starch and sugar must be converted through fermentation. This process includes yeast consuming carbohydrates and releasing carbon dioxide, which is an odorless, colorless and a toxic gas.
    - At 1,000 parts per million (ppm), prolonged exposure can affect concentration. At 10,000 ppm the rate of breathing increases, and at 50,000 ppm the respiratory rate increases to four times normal respiration and signs of poisoning occur after only 30 minutes. That is why proper venting is critical.
    - Wastewater lagoons may emit unpleasant odors, much like a sewer, if they are not properly maintained.
    - Spray irrigation may emit unpleasant odors.
    - Chemicals used in cleaning the distillery may include chemicals like phosphoric acid, which are odorless but toxic.

- **Dust**
    - Dust is a common air pollutant. The type of road surfacing used can minimize dust issues…or worsen dust issues!

- **Noise**
    - Causes of continuous noise may include air discharges, air supply fans, pumps, and aerators on aerated lagoons. Bottling plants also create substantial noise.

C.K. Craven
Homeowner

- Causes of intermittent noise may include heavy tankers and heavy trucks, delivery trucks, employee and visitor traffic plus possibly high-pressure equipment noise and hammer noise.
  - A news report regarding Wheeler's Raid Distillery in TN in May 2019 contained noise complaints by the public for "tasting events and all weekend music" being highly disruptive, with minimal to no enforcement available in local zoning.
- Additional causes of intermittent noise include activities with loading, unloading, wastewater management, facility cleaning, and other similar activities. Clarification in the SUP about operating hours and these ancillary activities is essential to reduce the noise impact for the public.

QUESTIONS

1) What type of venting will be used in the distillery?

2) Will MFP follow OSHA Guidelines for safety in distilleries?

3) Will MFP agree to put sound silencers on air intake fans, air dischargers and other equipment as identified?

4) Will MFP agree to provide acoustic enclosure of outdoor mechanical equipment such as pumps?

5) Will ZBOA require adherence to operating hours and delivery hours Monday through Saturday 7am to 7pm and Saturdays from 8am to 4pm to mitigate additional noise?

6) What would be the reasons for increases in "...additional traffic, visual changes, additional buildings, night-time lighting, and some noise?

7) What types of "additional buildings" might be built?

8) If additional buildings are proposed and additional employees needed, does that have to go before the ZBOA? It would increase water use, wastewater amounts, and traffic/

Respectfully submitted,

Carolyn K. Craven
101 14th Avenue South
Great Falls, MT 59405

Montanans for Responsible Land Use

C.K. Craven
Homeowner